A BIOLOGICAL ASSESSMENT OF SITES IN THE NINEMILE CREEK DRAINAGE, MISSOULA COUNTY, MONTANA

TMDL-C04

July 2003

A report to

The Montana Department of Environmental Quality
Planning, Prevention and Assistance Division
Helena, Montana
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by

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February 2004

INTRODUCTION

Aquatic invertebrates are aptly applied to bioassessment since they are known to be important indicators of stream ecosystem health (Hynes 1970). Long lives, complex life cycles and limited mobility mean that there is ample time for the benthic community to respond to cumulative effects of environmental perturbations. This report summarizes data collected in July 2003 from 8 sites in the Ninemile Creek drainage. Sites were located in Missoula County, Montana and lie within the Northern Rockies ecoregion (Woods et al. 1999).

A multimetric approach to bioassessment such as the one applied in this study uses attributes of the assemblage in an integrated way to measure biotic health. A stream with good biotic health is "...a balanced, integrated, adaptive system having the full range of elements and processes that are expected in the region's natural environment..." (Karr and Chu 1999). The approach designed by Plafkin et al. (1989) and adapted for use in the State of Montana has been defined as "... an array of measures or metrics that individually provide information on diverse biological attributes, and when integrated, provide an overall indication of biological condition." (Barbour et al. 1995). Community attributes that can contribute meaningfully to interpretation of benthic data include assemblage structure, sensitivity of community members to stress or pollution, and functional traits. Each metric component contributes an independent measure of the biotic integrity of a stream site; combining the components into a total score reduces variance and increases precision of the assessment (Fore et al. 1996). Effectiveness of the integrated metrics depends on the applicability of the underlying model, which rests on a foundation of three essential elements (Bollman 1998a). The first of these is an appropriate stratification or classification of stream sites, typically by ecoregion. Second, metrics must be selected based upon their ability to accurately express biological condition. Third, an adequate assessment of habitat conditions at each site to be studied enhances the interpretation of metric outcomes.

Implicit in the multimetric method and its associated habitat assessment is an assumption of correlative relationships between habitat measures and the biotic metrics, in the absence of water quality impairment. These relationships may vary regionally, requiring an examination of habitat assessment elements and biotic metrics and a test of the presumed relationship between them. Bollman (1998a) has studied the assemblages of the Montana Valley and Foothill Prairies (MVFP) ecoregion and has recommended a battery of metrics applicable to the montane ecoregions of western Montana. This metric battery has been shown to be sensitive to impairment, related to measures of habitat integrity, and consistent over replicated samples. However, scoring criteria developed for the MVFP ecoregion metric battery may not be appropriately sensitive for streams of the Northern Rockies ecoregion. Additional work may be needed to calibrate scoring to montane regions, thus impairment classifications must be interpreted with care.

METHODS

Samples were collected in July 2003 by personnel of the Montana Department of Environmental Quality (Montana DEQ). Sample designations and site locations are indicated in Table 1 and on Figure 1. The site selection and kicknet sampling method employed were those recommended in the Montana DEQ Standard Operating Procedures for Aquatic Macroinvertebrate Sampling (Bukantis 1998). Aquatic invertebrate samples were delivered to Rhithron Associates, Inc., Missoula, Montana, for laboratory and data analyses. In the laboratory, the Montana DEQ-recommended sorting method was used to obtain subsamples of at least 300 organisms from each sample, when possible. Organisms were identified to the lowest possible taxonomic levels consistent with Montana DEQ protocols.

Table 1. Sample designations and locations. Sites are listed in upstream-to-downstream order. Ninemile Creek drainage. July 2003.

Site ID	Station ID	Activity ID	Location Description	Collection Date	Latitude	Longitude
BBLUC 01	C04BBLUC01	03-C212-M	BIG BLUE CREEK 400 YDS U/S FROM MOUTH OF NINEMILE CREEK	07/25/03	47°-11'-34"	114°-35'-43"
JOSPC 01	C04JOSPC01	03-C214-M	JOSEPHINE CREEK U/S OF FS RD 890 100 YDS	07/26/03	47°-11'-09"	114°-29'-42"
JOSPC 02	C04JOSPC02	03-C213-M	JOSEPHINE CREEK 100 YDS U/S OF MOUTH OF NINEMILE CREEK	07/26/03	47°-08'-53"	114°-31'-59"
MCOR C02	C04MCORC02	03-C211-M	MCCORMICK CREEK 250 YDS U/S OF CONFLUENCE OF LITTLE MCCORMICK CREEK	07/24/03	47°-09'-09"	114°-29'-12"
MCOR C01	C04MCORC01	03-C209-M	MCCORMICK CREEK 0.25 MI ABOVE MOUTH	07/24/03	47°-08'-08"	114°-30'-46"
CEDRC 01	C04CEDRC01	03-C215-M	CEDAR CREEK 0.5-0.75 MI UP STARK MTN TRAIL #58 ABOVE FS 5515	07/29/03	47°-05'-22"	114°-30'-57"
STNYC 01	C04STNYC01	03-C208-M	STONY CREEK 250 YDS ABOVE FR 5490 XING	07/24/03	47°-06'-39"	114°-23'-43"
STNYC 02	C04STNYC02	03-C207-M	STONY CREEK 0.25 MI U/S FROM MOUTH OF NINEMILE CREEK	07/23/03	47°-04'-22"	114°-25'-41"

To assess aquatic invertebrate communities, a multimetric index developed in previous work for streams of western Montana ecoregions (Bollman 1998a) was used. Multimetric indices result in a single numeric score, which integrates the values of several individual indicators of biologic health. Each metric used in this index was tested for its response or sensitivity to varying degrees of human influence. Correlations have been demonstrated between the metrics and various symptoms of human-caused impairment as expressed in water quality parameters or instream, streambank, and stream reach morphologic features. Metrics were screened to minimize variability over natural environmental gradients, such as site elevation or sampling season, which might confound interpretation of results (Bollman 1998a). The multimetric index used in this report incorporates multiple attributes of the sampled assemblage into an integrated score that accurately describes the benthic community of each site in terms of its biologic integrity. In addition to the metrics comprising the index, other metrics shown to be applicable to biomonitoring in other regions (Kleindl 1995, Patterson 1996, Rossano 1995) were used for descriptive interpretation of results. These metrics include the number of "clinger" taxa, long-lived taxa richness, the percent of predatory organisms, and others. They are not included in the integrated bioassessment score, however, since their performance in western Montana ecoregions is unknown. However, the relationship of these metrics to habitat conditions is intuitive and reasonable.

The six metrics comprising the bioassessment index used for MVFP sites in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998a). In addition, they are relevant to the kinds of impacts that are present in the Ninemile Creek drainage. They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998a). Each of the six metrics developed and tested for western Montana ecoregions is described below.

1. **Ephemeroptera (mayfly) taxa richness.** The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.

2. **Plecoptera (stonefly) taxa richness.** Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.

3. **Trichoptera (caddisfly) taxa richness.** Caddisfly taxa richness has been shown to decline when sediment deposition affects habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.

4. **Number of sensitive taxa.** Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998a).

5. **Percent filter feeders.** Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* spp. and *Parapsyche* spp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.

6. **Percent tolerant taxa.** Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others.

Scoring criteria for each of the six metrics are presented in Table 2. Metrics differ in their possible value ranges as well as in the direction the values move as biological conditions change. For example, Ephemeroptera richness values may range from zero to ten taxa or higher. Larger values generally indicate favorable biotic conditions. On the other hand, the percent filterers metric may range from 0% to 100%; in this case, larger values are negative indicators of biotic health. To facilitate scoring, therefore, metric values were transformed into a single scale. The range of each metric has been divided into four parts and assigned a point score between zero and three. A score of three indicates a metric value similar to one characteristic of a non-impaired condition. A score of zero indicates strong deviation from non-impaired condition and suggests severe degradation of biotic health. Scores for each metric were summed to give an overall score, the total bioassessment score, for each site in each sampling event. These scores were expressed as the percent of the maximum possible score, which is 18 for this metric battery. The total bioassessment score for each site was

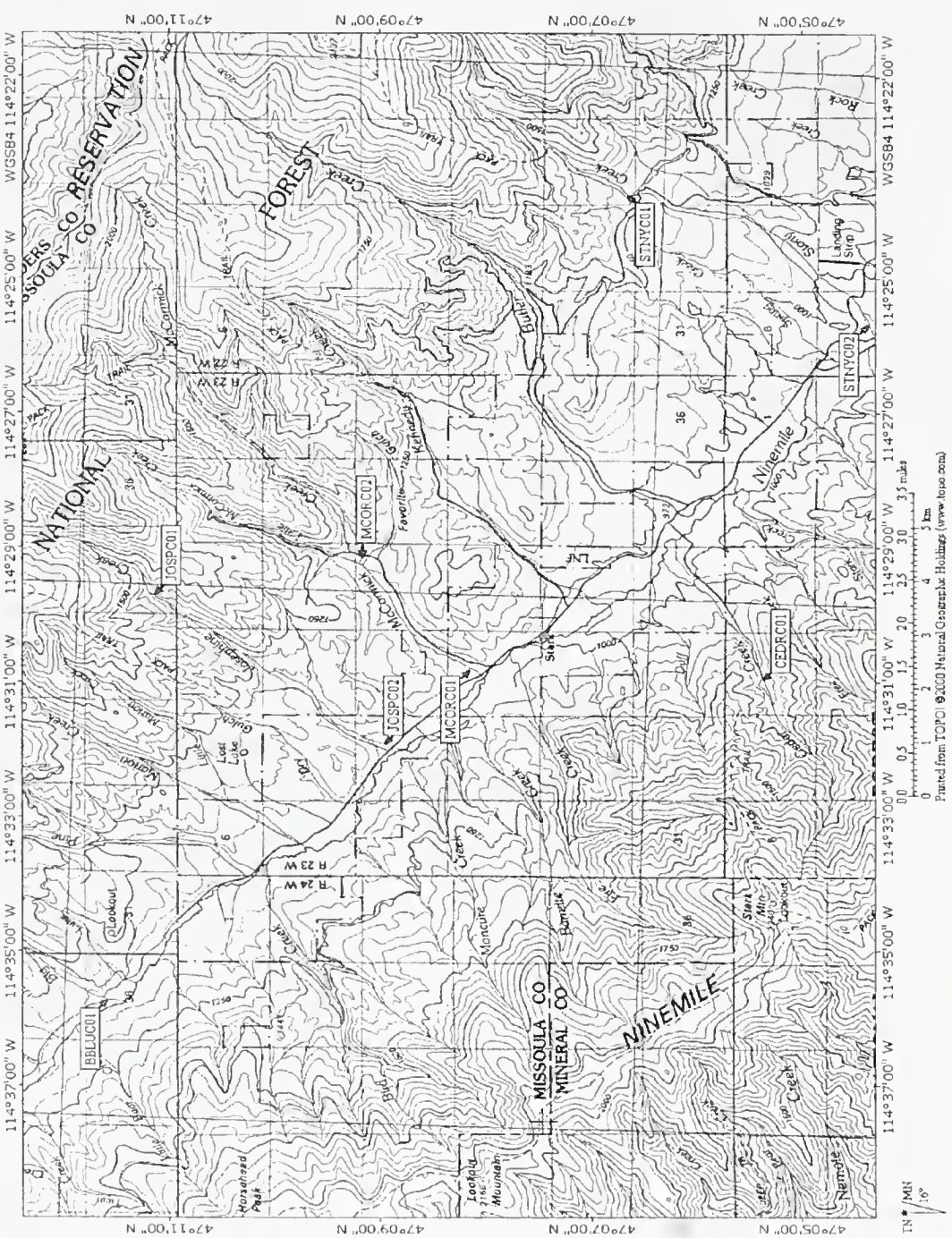


Figure 1. Approximate sampling locations. Ninemile Creek drainage. July 2003.

Table 2. Metrics and scoring criteria for bioassessment of montane streams of Western Montana (Bollman 1998a).

	Score			
Metric	**3**	**2**	**1**	**0**
Ephemeroptera taxa richness	> 5	5 - 4	3 – 2	< 2
Plecoptera taxa richness	> 3	3 - 2	1	0
Trichoptera taxa richness	> 4	4 - 3	2	< 2
Sensitive taxa richness	> 3	3 - 2	1	0
Percent filterers	0 – 5	5.01 - 10	10.01 – 25	> 25
Percent tolerant taxa	0 – 5	5.01 - 10	10.01 – 35	> 35

Table3a. Criteria for the assignment of use-support classifications / standards violation thresholds (Bukantis 1998).

% Comparability to reference	Use support
>75	Full support--standards not violated
25-75	Partial support--moderate impairment--standards violated
<25	Non-support--severe impairment--standards violated

Table3b. Criteria for the assignment of impairment classifications (Plafkin et al. 1989).

% Comparability to reference	Classification
> 83	nonimpaired
54-79	slightly impaired
21-50	moderately impaired
<17	severely impaired

expressed in terms of use-support. Criteria for use-support designations were developed by Montana DEQ and are presented in Table 3a. Scores were also translated into impairment classifications according to criteria outlined in Table 3b.

In this report, certain other metrics were used as descriptors of the benthic community response to habitat or water quality but were not incorporated into the bioassessment metric battery, either because they have not yet been tested for reliability in streams of western Montana, or because results of such testing did not show them to be robust at distinguishing impairment, or because they did not meet other requirements for inclusion in the metric battery. These metrics and their use in predicting the causes of impairment or in describing its effects on the biotic community are described below.

- The modified biotic index. This metric is an adaptation of the Hilsenhoff Biotic Index (HBI, Hilsenhoff 1987), which was originally designed to indicate organic enrichment of waters. Values of this metric are lowest in least impacted

conditions. Taxa tolerant to saprobic conditions are also generally tolerant of warm water, fine sediment and heavy filamentous algae growth (Bollman 1998b). Loss of canopy cover is often a contributor to higher biotic index values. The taxa values used in this report are modified to reflect habitat and water quality conditions in Montana (Bukantis 1998). Ordination studies of the benthic fauna of Montana's foothill prairie streams showed that there is a correlation between modified biotic index values and water temperature, substrate embeddedness, and fine sediment (Bollman 1998a). In a study of reference streams, the average value of the modified biotic index in least-impaired streams of western Montana was 2.5 (Wisseman 1992).

- Taxa richness. This metric is a simple count of the number of unique taxa present in a sample. Average taxa richness in samples from reference streams in western Montana was 28 (Wisseman 1992). Taxa richness is an expression of biodiversity, and generally decreases with degraded habitat or diminished water quality. However, taxa richness may show a paradoxical increase when mild nutrient enrichment occurs in previously oligotrophic waters, so this metric must be interpreted with caution.
- Percent predators. Aquatic invertebrate predators depend on a reliable source of invertebrate prey, and their abundance provides a measure of the trophic complexity supported by a site. Less disturbed sites have more plentiful habitat niches to support diverse prey species, which in turn support abundant predator species.
- Number of "clinger" taxa. So-called "clinger" taxa have physical adaptations that allow them to cling to smooth substrates in rapidly flowing water. Aquatic invertebrate "clingers" are sensitive to fine sediments that fill interstices between substrate particles and eliminate habitat complexity. Animals that occupy the hyporheic zones are included in this group of taxa. Expected "clinger" taxa richness in unimpaired streams of western Montana is at least 14 (Bollman 1998b).
- Number of long-lived taxa. Long-lived or semivoltine taxa require more than a year to completely develop, and their numbers decline when habitat and/or water quality conditions are unstable. They may completely disappear if channels are dewatered or if there are periodic water temperature elevations or other interruptions to their life cycles. Western Montana streams with stable habitat conditions are expected to support six or more long-lived taxa (Bollman 1998b).

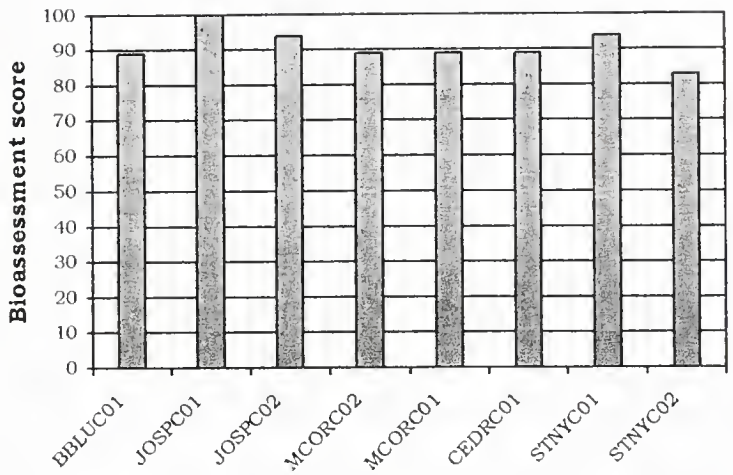
RESULTS

Bioassessment

Figure 2 summarizes bioassessment scores for aquatic invertebrate communities sampled from the Ninemile Creek drainage. Table 4 itemizes each contributing metric and shows individual metric scores for each site. Tables 3a and 3b above show criteria for impairment classifications (Plafkin et al. 1989) and use-support categories recommended by Montana DEQ (Bukantis 1998).

When this assessment method is applied to these data, scores indicate that all 8 studied sites were non-impaired and fully supported designated uses.

Figure 2. Comparison of total bioassessment scores (reported as percent of maximum score) for 8 sites in the Ninemile Creek drainage. July 2003. The revised bioassessment method (Bollman 1998a) was used to calculate scores.



Aquatic invertebrate communities

Interpretations of biotic integrity in this report are made without reference to results of habitat assessments, or any other information about the sites or watersheds that may have accompanied the invertebrate samples. Interpretations are based entirely on: the taxonomic and functional composition of the sampled invertebrate assemblages; the sensitivities, tolerances, physiology, and habitus information for individual taxa gleaned from the writer's research; the published literature, and other expert sources; and on the performance of bioassessment metrics, described earlier in the report, which have been demonstrated to be useful tools for interpreting potential implications of benthic invertebrate assemblage composition.

Big Blue Creek

A single site on Big Blue Creek (BBLUC01) was sampled for invertebrates. High mayfly taxa richness (12) at the site and low biotic index score calculated for the invertebrate assemblage suggest that water quality was excellent here. Among the 12 cold-stenotherms collected at the site were the stoneflies *Yoraperla brevis* and *Megarcys* sp. Cold, clean water appeared to provide the matrix for benthic animals characteristic of a non-impaired montane stream.

High numbers of "clinger" taxa (28) and caddisfly taxa (9) strongly imply that fine sediments did not substantially limit stony habitats. At least 49 taxa were supported at the site; instream habitats were likely complex. Stonefly taxa richness (8), which may be associated with reach-scale habitat features such as streambank stability, natural channel morphology, and riparian zone integrity, indicated intact habitats. Long-lived taxa were amply represented making it seem unlikely that scouring sediment pulses or dewatering limited long life cycles here. The functional mix included all expected components. Shredders were abundant, suggesting good riparian sources of large organic debris and suitable hydrology and channel complexity for its retention. The low numbers of scrapers suggests ample riparian shading; still, heptageniid mayflies (*Cinygmula* sp., *Epeorus* spp., *Ironodes* sp., etc.) were abundant enough to imply that metals contamination was probably not significant here.

Josephine Creek

Each of the 2 sampled sites on Josephine Creek (JOSPC01 and JOSPC02) supported sensitive assemblages indicative of excellent water quality conditions. Mayfly taxa richness was high at both sites (12 at the upper site, 8 at the lower site), and biotic index values (1.25 for the upper site, 2.81 for the lower site) were within expectations for an unpolluted mountain stream. Cold-stenotherms were diverse and abundant at each site.

Neither site exhibited evidence of excessive fine sediment deposition. Both "clingers" and caddisflies were amply represented in the sampled reaches. The upper site supported 11 caddisfly taxa and 19 "clinger" taxa while the lower site yielded 12 taxa and 23 taxa respectively. Exceptionally diverse assemblages (49 taxa at the upper site, 51 at the lower site) were collected at both sites, and stonefly richness (9 at the upper site, 7 at the lower) remained high along the longitudinal extent of the creek. Instream as well as reach scale habitat conditions were likely excellent. Dewatering and other limitations to long life cycles were probably not influential in Josephine Creek; semivoltine taxa were collected at both sites. Benthic assemblages were functionally similar in both reaches; all expected components were included. Shredders were abundant, implying ample riparian inputs of organic material.

McCormick Creek

Water quality indicators gave results indicating unpolluted water at the upstream site on McCormick Creek (MCORC02). The biotic index value (2.74) was low, and mayfly taxa richness high (9). The site supported at least 13 cold-stenotherm taxa.

High richness in both the "clinger" (27) and caddisfly (9) groups suggested that fine sediment deposition did not impair biologic health at this site. High overall taxa richness (51) and the large number of predator taxa (16) collected here likely reflect complex and undisturbed instream habitats. Six stonefly taxa were represented in the sample; reach scale habitat features were probably largely intact. Catastrophic dewatering or scouring sediment pulses seem unlikely, since 7 semivoltine taxa were counted. All expected components were present in the functional mix.

The biotic index value (3.65) calculated for the benthic assemblage collected at the downstream site on McCormick Creek (MCORC01) was higher than expected for a montane stream. The abundance of the midge *Cricotopus (Nostococladius)* accounts for the unexpected value returned for this metric. Montana DEQ Standard Operating Procedure calls for the assignment of a tolerance value of 6 for this taxon, which is considered by other biologists to be a sensitive, cold-stenotherm. Deleting the animal from the calculation results in a biotic index value of 2.56; this seems more consistent with the quality of the assemblage as a whole, and with the high mayfly taxa richness (8). Water quality was probably excellent at this site. Seven cold stenotherm taxa, including the stonefly *Megarcys* sp. were collected here.

Instream and reach scale indicators performed well at this site. Both "clinger" taxa (26) and caddisfly taxa (9) were well-represented. Stony benthic substrates were probably not impaired by excessive fine sediments. Forty-four taxa were counted in the sample; of these, 13 were predators. These findings imply that instream habitats were abundant and diverse here. The integrity of reach scale habitat features may be reflected in the high stonefly taxa richness (5). Five long-lived taxa were collected, implying that surface flow persisted year-round in this reach. All expected functional components were present.

Cedar Creek

The single sampled site on Cedar Creek (CEDRC01) supported a diverse, sensitive benthic assemblage. Mayfly taxa richness (8), the biotic index value (2.42) and the high number of cold-stenotherm taxa (9) all strongly suggest that cold, clean water characterized the visited reach.

Twenty "clinger" taxa and 8 caddisfly taxa were collected; fine sediment deposition probably did not limit access to hard substrates. Overall taxa richness (44) and predator richness (15) both suggest that a diversity of instream habitats were available. The rich stonefly fauna (8 taxa) may be related to undisturbed streambanks, natural channel morphology, and intact riparian zones. It seems unlikely that disastrous interruptions to long life cycles were recent, since at least 5 semivoltine taxa were present at the site. All expected functional components, in seemingly appropriate proportions, were collected.

Stony Creek

Two sites on Stony Creek were visited. At the upper site (STNYC01), the taxonomic composition and tolerance characteristics of the sampled assemblage suggest cold water of excellent quality. At least 11 cold-stenotherm taxa were resident in the reach, mayfly taxa richness (9) was high, and the biotic index value (1.90) was low. Among the sensitive taxa present here were the caddisfly *Cryptochia* sp. and the stonefly *Setvena bradleyi*.

Eighteen "clinger" taxa and 12 caddisfly taxa were collected, implying that fine sediment deposition was not a limitation to biotic health in this reach. Instream habitats were likely diverse and available, since 44 taxa were present in the sample; eleven of these were predators. Stonefly diversity (6 taxa) was high enough to suggest that reach scale habitat features such as channel morphology and riparian zones were in natural condition. Five semivoltine taxa were taken; surface flow likely persisted here year-round, and recent scouring sediment pulses seem unlikely. The functional composition seemed appropriately balanced among all expected feeding groups.

Good water quality apparently extended downstream to the lower site on Stony Creek (STNYC02), where high mayfly richness (7) and a low biotic index value (2.80) characterized the sampled assemblage. Cold-stenotherm taxa (3), however, were not as well-represented at this site compared to the other sites visited for this study. This may reflect somewhat warmer water temperatures in this reach.

Caddisfly taxa (9) and "clinger" taxa (17) were amply represented, suggesting that stony substrates were uncontaminated by excessive fine sediment deposition. Taxa richness (39) was within expectations for a montane stream. Stonefly taxa richness, however, was somewhat lower than expected; this may reflect disturbance to reach scale habitat features. Three taxa comprised the semivoltine fauna; all of these were elmid beetles. Periodic dewatering cannot be ruled out in this reach. Collectors were dominant among the functional groups.

CONCLUSIONS

- Seven of the sites studied supported diverse, sensitive, and functional benthic assemblages characteristic of unimpaired montane streams. These were the site on Big Blue Creek (BBLUC01), both site on Josephine Creek (JOSPC01 and JOSPC02), both sites on McCormick Creek (MCORC02 and MCORC01), the site on Cedar Creek (CEDRC01) and the upper site on Stony Creek (STNYC01).
- Evidence for somewhat warmer water temperatures and possible disturbance to reach scale habitat features could be discerned from the benthic assemblage sampled from the lower site on Stony Creek (STNYC02).

Table 4. Metric values, scores, and bioassessments for 8 sites In the Ninemile Creek drainage. July 2003. Site locations are given in Table 1. The revised bioassessment method (Bollman 1998a) was used to calculate scores.

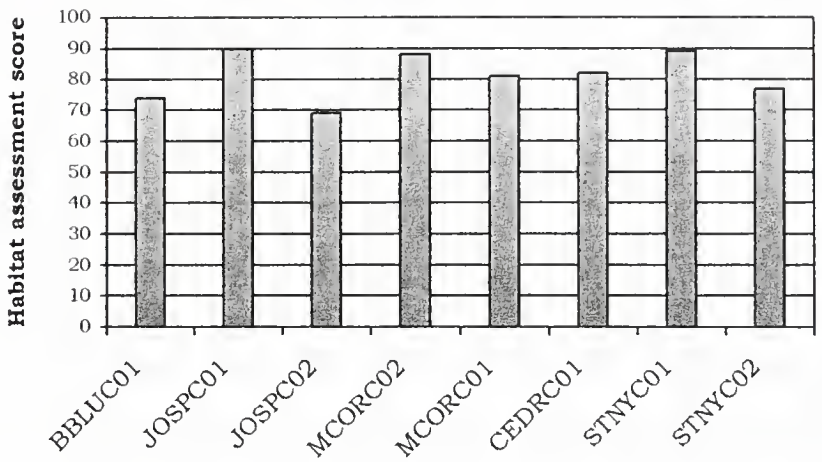
	SITES							
	BBLUC01	JOSPC01	JOSPC02	MCORC02	MCORC01	CEDRC01	STNYC01	STNYC02
METRICS	**METRIC VALUES**							
Ephemeroptera richness	12	12	8	9	8	8	9	7
Plecoptera richness	8	9	7	6	5	8	6	2
Trichoptera richness	9	11	12	9	9	6	12	9
Number of sensitive taxa	13	15	8	13	7	10	13	3
% filterers	14.00	0.61	4.56	10.60	3.69	12.77	6.04	6.47
% tolerant taxa	0.67	0.00	7.60	4.97	18.12	2.74	1.01	4.85
	METRIC SCORES							
Ephemeroptera richness	3	3	3	3	3	3	3	3
Plecoptera richness	3	3	3	3	3	3	3	2
Trichoptera richness	3	3	3	3	3	3	3	3
Number of sensitive taxa	3	3	3	3	3	3	3	2
% filterers	1	3	3	1	3	1	2	2
% tolerant taxa	3	3	2	3	1	3	3	3
TOTAL SCORE (max.=18)	16	18	17	16	16	16	17	15
PERCENT OF MAX.	**89**	**100**	**94**	**89**	**89**	**89**	**94**	**83**
Impairment classification*	**NON**	**NON**	**NON**	**NON**	**NON**	**NON**	**NON**	**NON**
USE SUPPORT †	**FULL**	**FULL**	**FULL**	**FULL**	**FULL**	**FULL**	**FULL**	**FULL**

* Impairment classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3b.† Use support designations: See Table 3a.

Habitat Assessment

Figure 3 graphically compares total habitat assessment scores recorded for the 8 sites in this study. Table 5 shows the habitat parameters evaluated, parameter scores and overall habitat evaluations for the sites studied.

Figure 3. Total habitat assessment scores for sites on the Ninemile Creek drainage. July 2003



Overall habitat conditions at the visited site on Big Blue Creek (BBLUC01) rated sub-optimal. Assessment forms delivered with the sample collected here indicate that the field investigator perceived severe sediment deposition at this site, although benthic substrate diversity was rated optimal. The riparian zone was noted to be abbreviated on the right side of the channel.

The upper site on Josephine Creek (JOSPC01) was judged to have optimal habitat conditions. All instream, streambank, and riparian zone parameters were noted to be in optimal or sub-optimal condition. Habitat at the lower site on Josephine Creek (JOSPC02) was perceived to be in sub-optimal overall condition. Moderate sediment deposition was noted, and flow status was rated marginal.

Both sites on McCormick Creek (MCCORC02 and MCCORC01) were rated optimal for overall habitat conditions. All instream and streambank parameters received optimal or sub-optimal scores; however, the riparian zone width was rated poor at the lower site.

Optimal conditions were perceived at the site on Cedar Creek (CEDRC01), in spite of moderate sediment deposition. All other parameters were scored optimally or sub-optimally.

The upper site on Stony Creek (STNYC01) received optimal scores for all streambank and riparian zone parameters, and for most instream habitat parameters. Channel flow status was judged sub-optimal. At the lower site (STNYC02), flow status rated a marginal score. The riparian zone was noted to be foreshortened on the right side of the channel. Overall habitat conditions rated sub-optimally.

Table 5. Stream and riparian habitat assessment. Sites were assessed based upon criteria developed by Montana DEQ for streams with riffle/run prevalence. The Ninemile Creek drainage. July 2003.

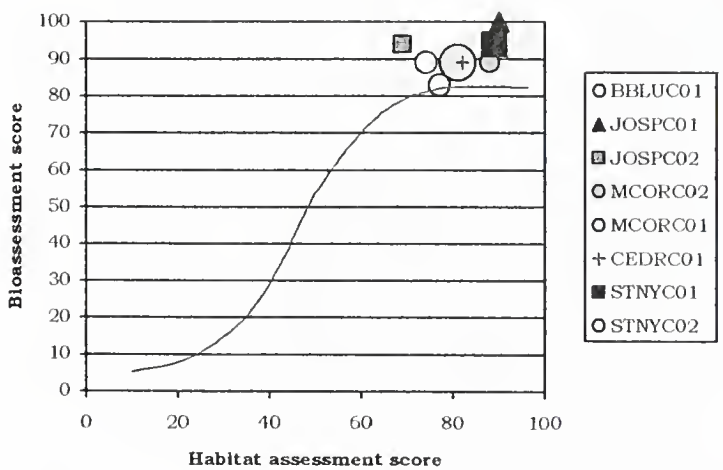
Max. possible score	Parameter	SITES							
		BBLUC 01	**JOSPC 01**	**JOSPC 02**	**MCORC 02**	**MCORC 01**	**CEDRC 01**	**STNYC 01**	**STNYC 02**
10	Riffle development	10	10	8	9	9	9	9	9
10	Benthic substrate	9	9	7	9	10	6	9	9
20	Embeddedness	16	19	11	18	17	16	18	17
20	Channel alteration	18	20	19	17	18	20	19	16
20	Sediment deposition	1	16	6	18	19	6	16	16
20	Channel flow status	18	15	8	17	14	17	15	7
20	Bank stability	9/8	9/8	7/7	7/7	9/8	9/9	9/9	9/9
20	Bank vegetation	10/9	9/9	9/9	9/9	9/8	10/10	9/9	9/9
20	Vegetated zone	6/5	10/10	10/10	10/10	6/2	10/10	10/10	8/5
160	Total	119	144	111	140	129	132	142	123
	Percent of maximum	**74%**	**90%**	**69%**	**88%**	**81%**	**82%**	**89%**	**77%**
	CONDITION*	**Sub-optimal**	**Optimal**	**Sub-optimal**	**Optimal**	**Optimal**	**Optimal**	**Optimal**	**Sub-optimal**

* Condition categories: Optimal > 80% of maximum score; Sub-optimal 75 - 56%; Marginal 49 - 29%; Poor <23%. Plafkin et al. 1989.

Habitat assessment vs. bioassessment

When habitat assessment scores are plotted against bioassessment scores, the resulting figure provides an opportunity to evaluate the hypothetical relationship between habitat integrity and water quality. Both factors are critical and interactive determinants of the composition and functional integrity of aquatic invertebrate assemblages. Presumably, high quality habitat, in the absence of impairments to water quality, supports functional, diverse, and sensitive invertebrate assemblages; these are assemblages that attain high bioassessment scores. Barbour and Stribling (1991) have hypothesized that diminishing habitat quality should produce predictable diminishment of bioassessment scores, when water quality is not a further insult. Figure 4 is a plot of habitat assessment scores against bioassessment scores (revised method) for the sampled assemblages of the Ninemile Creek drainage. The red line superimposed on the plot represents the hypothetical relationship between habitat quality and biotic integrity given good water quality. In this model, symbols falling in the upper right area of the graph would represent sites with high scores for both bioassessment and habitat assessment; according to this model, these would be unimpaired sites both in terms of habitat integrity as well as water quality. The plot in Figure 4 places all studied sites in the Ninemile Creek drainage in this region.

Figure 4. Total bioassessment scores plotted against habitat assessment scores for sites on the Ninemile Creek drainage. July 2003. (Barbour and Stribling 1991).



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APPENDIX

The Ninemile Creek drainage

Taxonomic data and metric summaries

July 2003

Aquatic Invertebrate Taxonomic Data
Site Name BIG BLUE CREEK 400 YRDS U/S FROM MOUTH 9MILE CR **STORET STATION** C04BBLUC01

Date Collected 7 /25/2003 **Activity ID** 03-C212-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
Coleoptera							
	Elmidae						
		Cleptelmis	1	0.33%	Yes	4	CG
		Elmidae	3	1.00%	No	4	CG
		Heterlimnius	22	7.33%	Yes	3	CG
		Lara avara	3	1.00%	Yes	1	SH
		Narpus	1	0.33%	Yes	2	CG
		Zaitzevia	1	0.33%	Yes	5	CG
Diptera							
	Ceratopogonidae						
		Ceratopogoninae	2	0.67%	Yes	6	PR
	Chironomidae						
		Brillia	42	14.00%	Yes	4	SH
		Eukiefferiella Brehmi Gr.	4	1.33%	Yes	8	CG
		Micropsectra	12	4.00%	Yes	4	CG
		Parametriocnemus	1	0.33%	Yes	5	CG
		Rheocricotopus	1	0.33%	Yes	4	CG
		Rheotanytarsus	12	4.00%	Yes	6	CF
		Tvetenia	6	2.00%	Yes	5	CG
	Empididae						
		Chelifera	1	0.33%	Yes	5	PR
		Empididae	1	0.33%	No	6	PR
	Ptychopteridae						
		Ptychoptera	1	0.33%	Yes	7	CG
	Simuliidae						
		Simulium	1	0.33%	Yes	6	CF
	Tipulidae						
		Dicranota	2	0.67%	Yes	3	PR
		Tipula	1	0.33%	Yes	4	SH
Ephemeroptera							
	Ameletidae						
		Ameletus	3	1.00%	Yes	0	CG
	Baetidae						
		Baetis tricaudatus	9	3.00%	Yes	4	CG
	Ephemerellidae						
		Caudatella	2	0.67%	Yes	0	CG
		Drunella doddsi	12	4.00%	Yes	1	PR
		Drunella spinifera	4	1.33%	Yes	0	PR
		Ephemerella	3	1.00%	Yes	1.5	SC
		Serratella	3	1.00%	Yes	2	CG
	Heptageniidae						
		Cinygmula	5	1.67%	Yes	0	SC
		Epeorus grandis	2	0.67%	Yes	0	SC
		Epeorus longimanus	2	0.67%	Yes	1	SC
		Ironodes	2	0.67%	Yes	0	SC
		Rhithrogena	7	2.33%	Yes	0	CG
Haplotaxida							
	Enchytraeidae						
		Enchytraeidae	1	0.33%	Yes	4	CG
Plecoptera							
	Chloroperlidae						
		Kathroperla	1	0.33%	Yes	1	CG
		Sweltsa	4	1.33%	Yes	0	PR
	Nemouridae						
		Malenka	5	1.67%	Yes	1	SH
		Visoka cataractae	4	1.33%	Yes	0	SH
		Zapada columbiana	3	1.00%	Yes	2	SH
	Peltoperlidae						
		Yoraperla brevis	4	1.33%	Yes	0	SH

(Continued.....)

Site Name BIG BLUE CREEK 400 YRDS U/S FROM MOUTH 9MILE CR **STORET STATION** C04BBLUC01

(...continued from previous page)

	Perlidae						
		Doroneuria	12	4.00%	Yes	0	PR
	Perlodidae						
		Megarcys	12	4.00%	Yes	1	PR
Trichoptera							
	Brachycentridae						
		Micrasema	5	1.67%	Yes	1	SH
	Hydropsychidae						
		Arctopsyche grandis	3	1.00%	Yes	2	PR
		Arctopsychinae	12	4.00%	No	2	PR
		Parapsyche elsis	5	1.33%	Yes	1	PR
	Lepidostomatidae						
		Lepidostoma (sand case)	2	0.67%	Yes	1	SH
	Limnephilidae						
		Ecclisomyia	4	1.33%	Yes	4	CG
	Philopotamidae						
		Dolophilodes	29	9.67%	Yes	0	CF
	Rhyacophilidae						
		Rhyacophila Betteni Gr.	7	2.33%	Yes	0	PR
		Rhyacophila Brunnea Gr.	8	2.67%	Yes	2	PR
		Rhyacophila narvae	2	0.67%	Yes	0	PR
Tricladida							
	Planariidae						
		Polycelis coronata	5	1.67%	Yes	1	OM
Grand Total			300				

Aquatic Invertebrate Data Summary

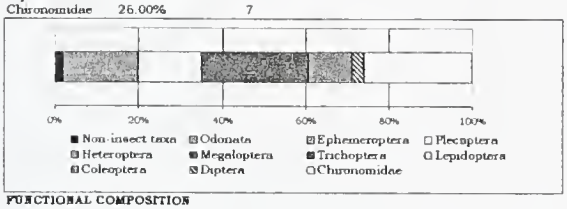
Project ID: MTDEQ03C04
STORET Station ID: C04BBLUC01
Station Name: BIG BLUE CREEK 400 YRDS U/S FROM MOUTH 9MILE CR

Activity ID: 03-C212-M
Sample Date: 7/25/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	300
Portion of sample used	40.00%
Estimated number in total sample	750
Sampling effort	
Time	DURATION 1 15 MINUTES / 20 FEET
Distance	
Jabs	
Habitat type	
EPT abundance	176
Taxa richness	49
Number EPT taxa	29
Percent EPT	58.67%

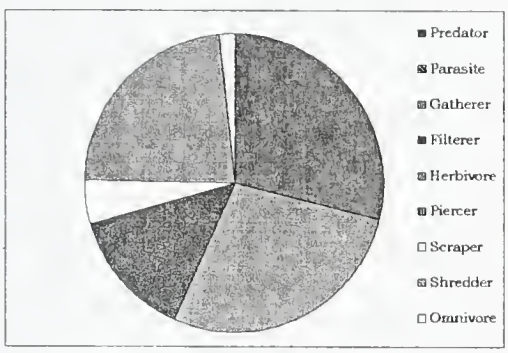
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	2.00%	2
Odonata	0.00%	0
Ephemeroptera	18.00%	12
Plecoptera	15.00%	8
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	25.67%	11
Lepidoptera	0.00%	0
Coleoptera	10.33%	6
Diptera	3.00%	7
Chironomidae	26.00%	7



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	29.00%	16
Parasite	0.00%	0
Gatherer	27.67%	19
Filterer	14.00%	3
Herbivore	0.00%	0
Piercer	0.00%	0
Scraper	4.67%	5
Shredder	23.00%	9
Omnivore	1.67%	1
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	2
Percent sediment tolerant	1.00%
Sediment sensitive taxa	3
Percent sediment sensitive	12.00%
Metals tolerance index (McGuire)	2.02
Cold stenotherm taxa	12
Percent cold stenotherms	30.67%

HABITUS MEASURES

Hemoglobin bearer richness	0
Percent hemoglobin bearers	0.00%
Air-breather richness	3
Percent air-breathers	1.33%
Burrower richness	6
Percent burrowers	16.33%
Swimmer richness	2
Percent swimmers	4.00%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Brillia	42	14.00%
Dolophilodes	29	9.67%
Heterlimnius	22	7.33%
Drunella doddsi	12	4.00%
Doroneuria	12	4.00%
SUBTOTAL 5 DOMINANTS	117	39.00%
Megarcys	12	4.00%
Arctopsychinae	12	4.00%
Micropsectra	12	4.00%
Rheotanytarsus	12	4.00%
Baetis tricaudatus	9	3.00%
TOTAL DOMINANTS	174	58.00%

SAPROBITY

Hilsenhoff Biotic Index	2.21

DIVERSITY

Shannon H (loge)	6.30
Shannon H (log2)	4.37
Margalef D	9.11
Simpson D	0.05
Evenness	0.08

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	9	30.67%
Univoltine	33	49.33%
Semivoltine	7	20.00%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	2	0.67%
Sensitive	13	31.00%
Clinger	28	59.33%

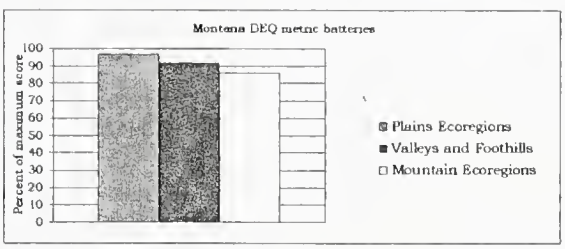
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	49	5	
E richness	12	5	
P richness	8	5	
T richness	11	5	
Long-lived	7	5	
Sensitive richness	13	5	
%tolerant	0.67%	5	
%predators	29.00%	3	
Clinger richness	28	5	
%dominance (3)	31.00%	5	
	TOTAL SCORE	48	96%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	49	3	3	3
EPT richness	29	3	3	3
Biotic Index	2.21	3	3	3
%Dominant taxon	14.00%	3	3	3
%Collectors	41.67%	3	3	3
%EPT	58.67%	3	2	2
Shannon Diversity	4.37	3		
%Scrapers +Shredders	27.67%	2	2	1
Predator taxa	16	3		
%Multivoltine	30.67%	3		
%H of T	25.97%		3	
TOTAL SCORES		29	22	18
PERCENT OF MAXIMUM		96.67	91.67	85.71
IMPAIRMENT CLASS		NON	NON	NON



Montana Plains ecoregions metrics (Brambiett and Johnson)

Riffle		*Pool*	
EPT richness	29	E richness	12
Percent EPT	58.67%	T richness	11
Percent Oligochaetes and Leeches	0.33%	Percent EPT	58.67%
Percent 2 dominants	23.67%	Percent non-insect	2.00%
Filterer richness	3	Filterer richness	3
Percent intolerant	57.33%	Univoltine richness	33
Univoltine richness	33	Percent supertolerant	1.33%
Percent clingers	59.33%		
Swimmer richness	2		

Aquatic Invertebrate Taxonomic Data
Site Name JOSEPHINE CREEK U/S OF FS RD 890 100 YDS **STORET STATION** C04JOSPC01

Date Collected 7 /26/2003 **Activity ID** 03-C214-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
		Nematoda	1	0.30%	Yes	5	PA
		Ostracoda	1	0.30%	Yes	8	CG
Acarina							
	Acari						
		Acari	1	0.30%	Yes	5	PR
Coleoptera							
	Elmidae						
		Heterlimnius	1	0.30%	Yes	3	CG
Diptera							
	Ceratopogonidae						
		Ceratopogoninae	1	0.30%	Yes	6	PR
	Chironomidae						
		Brillia	24	7.32%	Yes	4	SH
		Eukiefferiella Brehmi Gr.	1	0.30%	Yes	8	CG
		Eukiefferiella Devonica Gr.	3	0.91%	Yes	8	CG
		Micropsectra	11	3.35%	Yes	4	CG
		Pagastia	3	0.91%	Yes	1	CG
		Parametriocnemus	3	0.91%	Yes	5	CG
		Rheocricotopus	2	0.61%	Yes	4	CG
		Stempellinella	1	0.30%	Yes	4	CG
		Symposiocladius	1	0.30%	Yes	5	SH
	Empididae						
		Oreogeton	1	0.30%	Yes	4	PR
	Simuliidae						
		Prosimulium	2	0.61%	Yes	4	CF
Ephemeroptera							
	Ameletidae						
		Ameletus	9	2.74%	Yes	0	CG
	Baetidae						
		Baetis bicaudatus	8	2.44%	Yes	2	CG
		Baetis tricaudatus	1	0.30%	Yes	4	CG
	Ephemerellidae						
		Caudatella	1	0.30%	Yes	0	CG
		Drunella coloradensis	8	2.44%	Yes	0	PR
		Drunella doddsi	18	5.49%	Yes	1	PR
		Ephemerella	6	1.83%	Yes	1.5	SC
		Serratella tibialis	8	2.44%	Yes	2	CG
	Heptageniidae						
		Cinygmula	26	7.93%	Yes	0	SC
		Epeorus deceptivus	27	8.23%	Yes	0	SC
		Epeorus grandis	3	0.91%	Yes	0	SC
		Rhithrogena	11	3.35%	Yes	0	CG
Plecoptera							
	Chloroperlidae						
		Suwallia	1	0.30%	Yes	1	PR
		Sweltsa	10	3.05%	Yes	0	PR
	Leuctridae						
		Leuctridae	2	0.61%	Yes	0	SH
	Nemouridae						
		Visoka cataractae	10	3.05%	Yes	0	SH
		Zapada columbiana	25	7.62%	Yes	2	SH
		Zapada Oregonensis Gr.	4	1.22%	Yes	2	SH
	Peltoperlidae						
		Yoraperla brevis	42	12.80%	Yes	0	SH
	Perlidae						
		Doroneuria	7	2.13%	Yes	0	PR
	Perlodidae						
		Megarcys	7	2.13%	Yes	1	PR

(Continued.....)

Site Name JOSEPHINE CREEK U/S OF FS RD 890 100 YDS **STORET STATION** C04JOSPC01

(...continued from previous page)

Trichoptera							
	Brachycentridae						
		Micrasema	3	0.91%	Yes	1	SH
	Hydropsychidae						
		Parapsyche elsis	4	1.22%	Yes	1	PR
	Lepidostomatidae						
		Lepidostoma (sand case)	1	0.30%	Yes	1	SH
	Limnephilidae						
		Dicosmoecus gilvipes	1	0.30%	Yes	2	SC
		Homophylax	1	0.30%	Yes	2	SH
		Limnephilidae	2	0.61%	Yes	3	SH
	Rhyacophilidae						
		Rhyacophila	3	0.91%	Yes	1	PR
		Rhyacophila Betteni Gr.	2	0.61%	Yes	0	PR
		Rhyacophila Hyalinata Gr.	1	0.30%	Yes	0	PR
		Rhyacophila narvae	4	1.22%	Yes	0	PR
	Uenoidae						
		Neothremma	1	0.30%	Yes	1	SC
Tricladida							
	Planariidae						
		Polycelis coronata	14	4.27%	Yes	1	OM
Grand Total			328				

Aquatic Invertebrate Data Summary

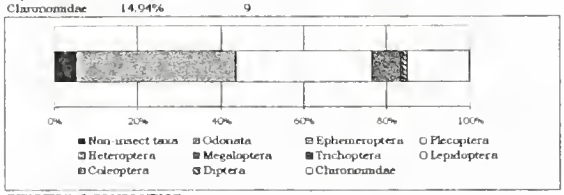
Project ID: MTDEQ03C04
STORET Station ID: C04JOSPC01
Station Name: JOSEPHINE CREEK U/S OF FS RD 890 100 YDS

Activity ID: 03-C214-M
Sample Date: 7/26/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	328
Portion of sample used	56.67%
Estimated number in total sample	579
Sampling effort	
Time	DURATION, 1 1/5 MINUTES / 20 FEET
Distance	
Jabs	
Habitat type	
EPT abundance	257
Taxa richness	49
Number EPT taxa	32
Percent EPT	78.35%

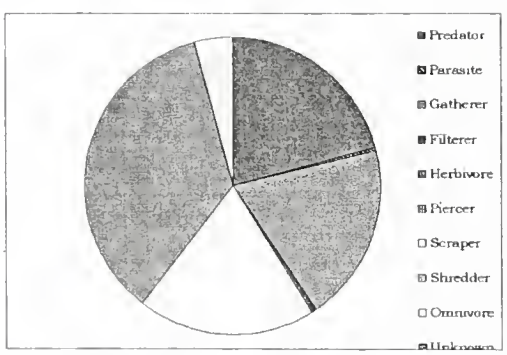
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	5.18%	4
Odonata	0.00%	0
Ephemeroptera	38.41%	12
Plecoptera	32.93%	9
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	7.01%	11
Lepidoptera	0.00%	0
Coleoptera	0.30%	1
Diptera	1.22%	3
Chironomidae	14.94%	9



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	20.73%	14
Parasite	0.30%	1
Gatherer	19.51%	15
Filterer	0.61%	1
Herbivore	0.00%	0
Piercer	0.00%	0
Scraper	19.51%	6
Shredder	35.06%	11
Omnivore	4.27%	1
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	0
Percent sediment tolerant	0.00%
Sediment sensitive taxa	1
Percent sediment sensitive	1.22%
Metals tolerance index (McGuire)	1.46
Cold stenotherm taxa	15
Percent cold stenotherms	47.87%

HABITUS MEASURES

Hemoglobin bearer richness	0
Percent hemoglobin bearers	0.00%
Air breather richness	0
Percent air-breathers	0.00%
Burrower richness	3
Percent burrowers	7.93%
Swimmer richness	3
Percent swimmers	5.49%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Yoraperla brevis	42	12.80%
Epeorus deceptivus	27	8.23%
Cinygmula	26	7.93%
Zapada columbiana	25	7.62%
Brillia	24	7.32%
SUBTOTAL 5 DOMINANTS	144	43.90%
Drunella doddsi	18	5.49%
Polycelis coronata	14	4.27%
Rhithrogena	11	3.35%
Micropsectra	11	3.35%
Sweltsa	10	3.05%
TOTAL DOMINANTS	208	63.41%

SAPROBITY

Hilsenhoff Biotic Index	1.25

DIVERSITY

Shannon H (loge)	5.89
Shannon H (log2)	4.08
Margalef D	8.28
Simpson D	0.05
Evenness	0.08

VOLTINISM

TYPE	#TAXA	PERCENT
Multivoltine	15	22.87%
Univoltine	30	73.17%
Semivoltine	4	3.96%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	0	0.00%
Sensitive	15	47.87%
Clinger	19	53.96%

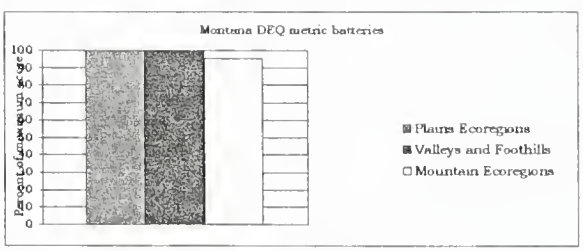
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	49	5	
E richness	12	5	
P richness	9	5	
T richness	11	5	
Long-lived	4	3	
Sensitive richness	15	5	
%tolerant	0.00%	5	
%predators	20.73%	3	
Clinger richness	19	3	
%dominance (3)	28.96%	5	
	TOTAL SCORE	44	88%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	49	3	3	3
EPT richness	32	3	3	3
Biotic Index	1.25	3	3	3
%Dominant taxon	12.80%	3	3	3
%Collectors	20.12%	3	3	3
%EPT	78.35%	3	3	3
Shannon Diversity	4.08	3		
%Scrapers +Shredders	54.57%	3	3	2
Predator taxa	14	3		
%Multivoltine	22.87%	3		
%H of T	17.39%		3	
TOTAL SCORES		30	24	20
PERCENT OF MAXIMUM		100.00	100.00	95.24
IMPAIRMENT CLASS		NON	NON	NON



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	32	E richness	12
Percent EPT	78.35%	T richness	11
Percent Oligochaetes and Leeches	0.00%	Percent EPT	78.35%
Percent 2 dominants	21.04%	Percent non-insect	5.18%
Filterer richness	1	Filterer richness	1
Percent intolerant	82.62%	Univoltine richness	30
Univoltine richness	30	Percent supertolerant	1.52%
Percent clingers	53.96%		
Swimmer richness	3		

Aquatic Invertebrate Taxonomic Data
Site Name JOSEPHINE CREEK 100 YRDS U/S OF MOUTH 9MILE CREEK **STORET STATION** C04JOSPC02

Date Collected 7 /26/2003 **Activity ID** 03-C213-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
		Nematoda	1	0.30%	Yes	5	PA
Coleoptera							
	Dytiscidae						
		Oreodytes	3	0.91%	Yes	5	PR
	Elmidae						
		Heterlimnius corpulentus	5	1.52%	Yes	3	CG
		Lara avara	2	0.61%	Yes	1	SH
		Narpus	1	0.30%	Yes	2	CG
		Zaitzevia	20	6.08%	Yes	5	CG
	Hydrophilidae						
		Hydrobius	1	0.30%	Yes	8	PR
Diptera							
	Ceratopogonidae						
		Ceratopogoninae	2	0.61%	Yes	6	PR
	Chironomidae						
		Brillia	87	26.44%	Yes	4	SH
		Corynoneura	1	0.30%	Yes	7	CG
		Cricotopus (Cricotopus)	3	0.91%	Yes	7	SH
		Cricotopus (Nostococladius)	2	0.61%	Yes	6	SH
		Eukiefferiella Devonica Gr.	1	0.30%	Yes	8	CG
		Micropsectra	2	0.61%	Yes	4	CG
		Microtendipes	2	0.61%	Yes	6	CF
		Pagastia	2	0.61%	Yes	1	CG
		Rheotanytarsus	3	0.91%	Yes	6	CF
		Thienemanniella	3	0.91%	Yes	6	CG
		Thienemannimyia Gr.	4	1.22%	Yes	5	PR
		Tvetenia	11	3.34%	Yes	5	CG
	Simuliidae						
		Simulium	1	0.30%	Yes	6	CF
	Tipulidae						
		Dicranota	2	0.61%	Yes	3	PR
Ephemeroptera							
	Ameletidae						
		Ameletus	4	1.22%	Yes	0	CG
	Baetidae						
		Baetis tricaudatus	2	0.61%	Yes	4	CG
		Diphetor hageni	2	0.61%	Yes	5	CG
	Ephemerellidae						
		Drunella spinifera	2	0.61%	Yes	0	PR
		Serratella tibialis	16	4.86%	Yes	2	CG
	Heptageniidae						
		Ironodes	29	8.81%	Yes	0	SC
		Rhithrogena	10	3.04%	Yes	0	CG
	Leptophlebiidae						
		Paraleptophlebia	3	0.91%	Yes	1	CG
Haplotaxida							
	Enchytraeidae						
		Enchytraeidae	1	0.30%	Yes	4	CG
Plecoptera							
	Chloroperlidae						
		Sweltsa	3	0.91%	Yes	0	PR
	Leuctridae						
		Leuctridae	1	0.30%	Yes	0	SH
	Nemouridae						
		Malenka	8	2.43%	Yes	1	SH
		Zapada cinctipes	5	1.52%	Yes	3	SH
		Zapada columbiana	2	0.61%	Yes	2	SH

(Continued.....)

Site Name JOSEPHINE CREEK 100 YRDS U/S OF MOUTH 9MILE CREEK **STORET STATION** C04JOSPC02

(...continued from previous page)

	Perlidae						
		Doroneuria	6	1.82%	Yes	0	PR
		Perlidae	4	1.22%	No	2	PR
	Perlodidae						
		Megarcys	1	0.30%	Yes	1	PR
Trichoptera							
	Brachycentridae						
		Micrasema	7	2.13%	Yes	1	SH
	Hydropsychidae						
		Arctopsyche grandis	22	6.69%	Yes	2	PR
		Hydropsyche	5	1.52%	Yes	5	CF
	Hydroptilidae						
		Ochrotrichia	5	1.52%	Yes	4	PH
	Lepidostomatidae						
		Lepidostoma (panel case)	2	0.61%	Yes	1	SH
		Lepidostoma (turret case)	13	0.61%	Yes	1	SH
	Limnephilidae						
		Ecclisomyia	1	0.30%	Yes	4	CG
		Onocosmoecus	3	0.91%	Yes	3	SH
	Philopotamidae						
		Dolophilodes	1	0.30%	Yes	0	CF
		Wormaldia	3	0.91%	Yes	0	CF
	Rhyacophilidae						
		Rhyacophila	5	1.52%	No	1	PR
		Rhyacophila Brunnea Gr.	1	0.30%	Yes	2	PR
		Rhyacophila narvae	1	0.30%	Yes	0	PR
Tricladida							
	Planariidae						
		Polycelis coronata	2	0.61%	Yes	1	OM
Grand Total			329				

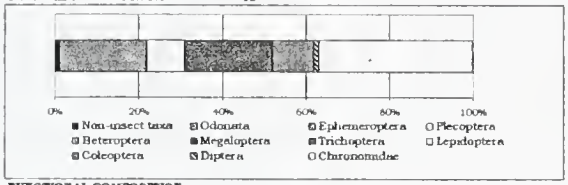
Aquatic Invertebrate Data Summary

Project ID:	MTDEQ03C04	**Activity ID:**	03-C213-M
STORET Station ID:	C04JOSPC02		
Station Name:	JOSEPHINE CREEK 100 YRDS D/S OF MOUTH 9MILE CREEK	**Sample Date:**	7/26/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	329
Portion of sample used	53.33%
Estimated number in total sample	617
Sampling effort	
Time	DURATION 2:30 MINUTES / 30 FEET
Distance	
Jabs	
Habitat type	
EPT abundance	167
Taxa richness	51
Number EPT taxa	27
Percent EPT	50.76%

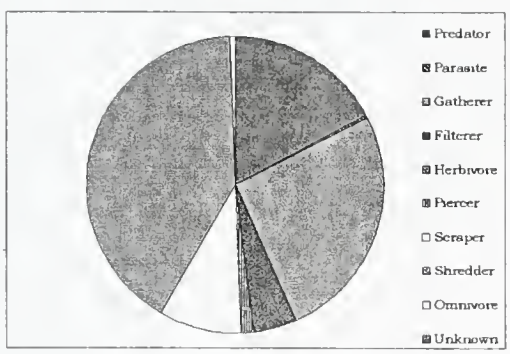
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	1.22%	3
Odonata	0.00%	0
Ephemeroptera	20.67%	8
Plecoptera	9.12%	8
Beteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	20.97%	13
Lepidoptera	0.00%	0
Coleoptera	9.73%	6
Diptera	1.52%	3
Chironomidae	36.78%	12



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	17.33%	14
Parasite	0.30%	1
Gatherer	25.84%	17
Filterer	4.56%	6
Herbivore	0.00%	0
Piercer	1.52%	1
Scraper	8.81%	1
Shredder	41.03%	12
Omnivore	0.61%	1
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	1
Percent sediment tolerant	0.61%
Sediment sensitive taxa	4
Percent sediment sensitive	8.51%
Metals tolerance index (McGuire)	2.65
Cold stenotherm taxa	8
Percent cold stenotherms	4.86%

HABITUS MEASURES

Hemoglobin bearer richness	1
Percent hemoglobin bearers	0.61%
Air-breather richness	3
Percent air-breathers	1.82%
Burrower richness	3
Percent burrowers	27.66%
Swimmer richness	5
Percent swimmers	4.26%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Brilha	87	26.44%
Ironodes	29	8.81%
Arctopsyche grandis	22	6.69%
Zaitzevia	20	6.08%
Serratella tibialis	16	4.86%
SUBTOTAL 5 DOMINANTS	174	52.89%
Lepidostoma (turret case)	13	3.95%
Tvetenia	11	3.34%
Rhithrogena	10	3.04%
Malenka	8	2.43%
Micrasema	7	2.13%
TOTAL DOMINANTS	223	67.78%

SAPROBITY

Hilsenhoff Biotic Index	2.81

DIVERSITY

Shannon H (loge)	5.16
Shannon H (log2)	3.58
Mergalef D	8.97
Simpson D	0.09
Evenness	0.07

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	17	40.43%
Univoltine	27	40.73%
Semivoltine	7	18.84%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	2	7.60%
Sensitive	8	4.86%
Clinger	23	44.98%

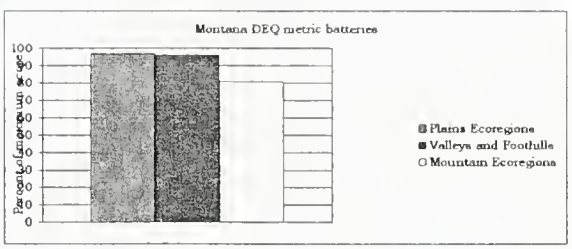
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	51	5	
E richness	8	3	
P richness	8	5	
T richness	13	5	
Long-lived	7	5	
Sensitive richness	8	5	
%tolerant	7.60%	5	
%predators	17.33%	3	
Clinger richness	23	5	
%dominance (3)	41.95%	3	
	TOTAL SCORE	46	92%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	51	3	3	3
EPT richness	27	3	3	3
Biotic Index	2.81	3	3	3
%Dominant taxon	26.44%	3	3	2
%Collectors	30.40%	3	3	3
%EPT	50.76%	3	2	1
Shannon Diversity	3.58	3		
%Scrapers +Shredders	49.85%	3	3	2
Predator taxa	14	3		
%Multivoltine	40.43%	2		
%H of T	39.13%		3	
TOTAL SCORES		29	23	17
PERCENT OF MAXIMUM		96.67	95.83	80.95
IMPAIRMENT CLASS		NON	NON	SLIGHT



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	27	E richness	8
Percent EPT	50.76%	T richness	13
Percent Oligochaetes and Leeches	0.30%	Percent EPT	50.76%
Percent 2 dominants	35.26%	Percent non-insect	1.22%
Filterer richness	6	Filterer richness	6
Percent intolerant	45.90%	Univoltine richness	27
Univoltine richness	27	Percent supertolerant	0.61%
Percent clingers	44.98%		
Swimmer richness	5		

Aquatic Invertebrate Taxonomic Data

Site Name MCCORMICK CREEK 250 YDS U/S OF CONFL. OF LTL MCCORMICK CR **STORET STATION** C04MCORC02

Date Collected 7 /24/2003 **Activity ID** 03-C211-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
		Nematoda	1	0.33%	Yes	5	PA
Acarina							
	Acari						
		Acari	6	1.99%	Yes	5	PR
Coleoptera							
	Elmidae						
		Cleptelmis	7	2.32%	Yes	4	CG
		Heterlimnius	20	6.62%	Yes	3	CG
		Lara avara	5	1.66%	Yes	1	SH
		Narpus	1	0.33%	Yes	2	CG
		Zaitzevia	8	2.65%	Yes	5	CG
Diptera							
	Ceratopogonidae						
		Ceratopogoninae	1	0.33%	Yes	6	PR
	Chironomidae						
		Brillia	17	5.63%	Yes	4	SH
		Cricotopus (Cricotopus)	1	0.33%	Yes	7	SH
		Cricotopus (Nostococladius)	1	0.33%	Yes	6	SH
		Eukiefferiella Gracei Gr.	1	0.33%	Yes	8	CG
		Larsia	1	0.33%	Yes	6	PR
		Microtendipes	12	3.97%	Yes	6	CF
		Pagastia	2	0.66%	Yes	1	CG
		Parametriocnemus	1	0.33%	Yes	5	CG
		Polypedilum	24	7.95%	Yes	6	SH
		Rheocricotopus	1	0.33%	Yes	4	CG
		Rheotanytarsus	18	5.96%	Yes	6	CF
		Thienemannimyia Gr.	1	0.33%	Yes	5	PR
	Empididae						
		Oreogeton	1	0.33%	Yes	4	PR
	Simuliidae						
		Simulium	1	0.33%	Yes	6	CF
	Tipulidae						
		Antocha	1	0.33%	Yes	3	CG
		Hexatoma	3	0.99%	Yes	2	PR
Ephemeroptera							
	Ameletidae						
		Ameletus	1	0.33%	Yes	0	CG
	Baetidae						
		Baetis tricaudatus	13	4.30%	Yes	4	CG
		Diphetor hageni	1	0.33%	Yes	5	CG
	Ephemerellidae						
		Caudatella edmundsi	1	0.33%	Yes	0	SC
		Drunella doddsi	2	0.66%	Yes	1	PR
		Drunella spinifera	19	6.29%	Yes	0	PR
		Serratella tibialis	19	6.29%	Yes	2	CG
	Heptageniidae						
		Cinygmula	8	2.65%	Yes	0	SC
		Rhithrogena	3	0.99%	Yes	0	CG
Haplotaxida							
	Enchytraeidae						
		Enchytraeidae	2	0.66%	Yes	4	CG
Plecoptera							
	Chloroperlidae						
		Sweltsa	5	1.66%	Yes	0	PR
	Nemouridae						
		Malenka	2	0.66%	Yes	1	SH
		Visoka cataractae	12	3.97%	Yes	0	SH
		Zapada columbiana	4	1.32%	Yes	2	SH

(Continued.....)

Site Name MCCORMICK CREEK 250 YDS U/S OF CONFL. OF LTL MCCORMICK CR **STORET STATION** C04MCORC02

(...continued from previous page)

	Perlidae						
		Doroneuria	9	2.98%	Yes	0	PR
	Perlodidae						
		Megarcys	1	0.33%	Yes	1	PR
Trichoptera							
	Brachycentridae						
		Micrasema	30	9.93%	Yes	1	SH
	Hydropsychidae						
		Arctopsyche grandis	1	0.33%	Yes	2	PR
		Parapsyche elsis	1	0.33%	Yes	1	PR
	Limnephilidae						
		Limnephilidae	4	1.32%	Yes	3	SH
	Philopotamidae						
		Dolophilodes	1	0.33%	Yes	0	CF
	Rhyacophilidae						
		Rhyacophila Alberta Gr.	2	0.66%	Yes	0	PR
		Rhyacophila Betteni Gr.	3	0.99%	Yes	0	PR
		Rhyacophila Brunnea Gr.	8	2.65%	Yes	2	PR
		Rhyacophila Verrula Gr.	1	0.33%	Yes	0	MH
Tricladida							
	Planariidae						
		Polycelis coronata	13	4.30%	Yes	1	OM
Veneroida							
	Pisidiidae						
		Pisidiidae	1	0.33%	Yes	8	CG
Grand Total			302				

Aquatic Invertebrate Data Summary

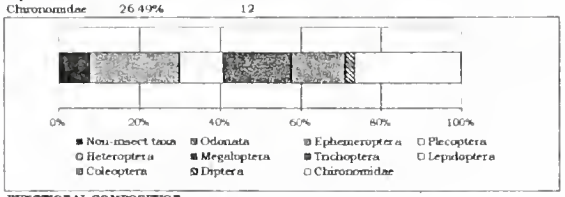
Project ID: MTDEQ03C04
STORET Station ID: C04MCORC02
Station Name: MCCORMICK CREEK 250 YDS U/S OF CONFL OF LTL MCCORMICK CR

Activity ID: 03-C211 M
Sample Date: 7/24/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	302
Portion of sample used	60 00%
Estimated number in total sample	503
Sampling effort	
Time	DURATION 1 30 MINUTES / 22 FEET
Distance	
Jabs	
Habitat type	
EPT abundance	151
Taxa richness	51
Number EPT taxa	24
Percent EPT	50 00%

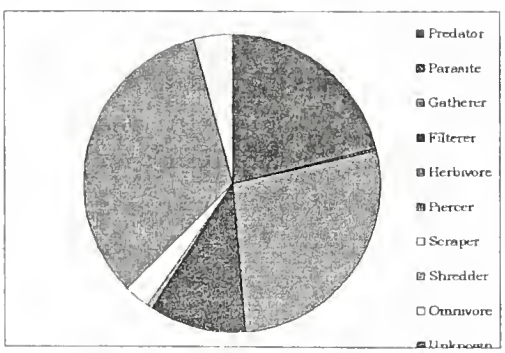
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	7 62%	5
Odonata	0 00%	0
Ephemeroptera	22 19%	9
Plecoptera	10 93%	6
Heteroptera	0 00%	0
Megaloptera	0 00%	0
Trichoptera	16 89%	9
Lepidoptera	0 00%	0
Coleoptera	13 58%	5
Diptera	2 32%	5
Chironomidae	26 49%	12



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	21 19%	16
Parasite	0 33%	1
Gatherer	27 15%	16
Filterer	10 60%	4
Herbivore	0 33%	1
Piercer	0 00%	0
Scraper	2 98%	2
Shredder	33 11%	10
Omnivore	4 30%	1
Unknown	0 00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	2
Percent sediment tolerant	1 32%
Sediment sensitive taxa	4
Percent sediment sensitive	1 32%
Metals tolerance index (McGuire)	2 28
Cold stenotherm taxa	13
Percent cold stenotherms	18 21%

HABITUS MEASURES

Hemoglobin bearer richness	2
Percent hemoglobin bearers	11 92%
Air-breather richness	2
Percent air-breathers	1 32%
Burrower richness	4
Percent burrowers	7 28%
Swimmer richness	3
Percent swimmers	4 97%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Micrasema	30	9 93%
Polypedilum	24	7 95%
Heterlimnius	20	6 62%
Drunella spinifera	19	6 29%
Serratella tibialis	19	6 29%
SUBTOTAL 5 DOMINANTS	112	37 09%
Rheotanytarsus	18	5 96%
Brilia	17	5 63%
Polycelis coronata	13	4 30%
Baetis tricaudatus	13	4 30%
Visoka cataractae	12	3 97%
TOTAL DOMINANTS	185	61 26%

SAPROBITY

Hilsenhoff Biotic Index	2.74

DIVERSITY

Shannon H (loge)	6 26
Shannon H (log2)	4 34
Margalef D	8 75
Simpson D	0 04
Evenness	0.09

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	17	37.75%
Univoltine	27	46.69%
Semivoltine	7	15 56%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	2	4 97%
Sensitive	13	18.21%
Clinger	27	65 89%

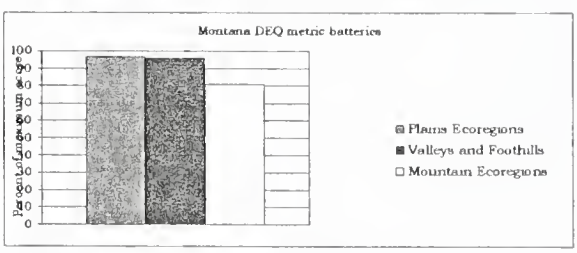
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	51	5	
E richness	9	5	
P richness	6	3	
T richness	9	3	
Long-lived	7	5	
Sensitive richness	13	5	
%tolerant	4 97%	5	
%predators	21 19%	3	
Clinger richness	27	5	
%dominance (3)	24 50%	3	
	TOTAL SCORE	44	88%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	51	3	3	3
EPT richness	24	3	3	3
Biotic Index	2.74	3	3	3
%Dominant taxon	9 93%	3	3	3
%Collectors	37 75%	3	3	3
%EPT	50.00%	2	2	1
Shannon Diversity	4 34	3		
%Scrapers +Shredders	36.09%	3	3	1
Predator taxa	16	3		
%Multivoltine	37.75%	3		
%H of T	3.92%		3	
TOTAL SCORES		29	23	17
PERCENT OF MAXIMUM		96 67	95 83	80 95
IMPAIRMENT CLASS		NON	NON	SLIGHT



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	24	E richness	9
Percent EPT	50 00%	T richness	9
Percent Oligochaetes and Leeches	0 66%	Percent EPT	50 00%
Percent 2 dominants	17 88%	Percent non-insect	7 62%
Filterer richness	4	Filterer richness	4
Percent intolerant	51 99%	Univoltine richness	27
Univoltine richness	27	Percent supertolerant	0 66%
Percent clingers	65 89%		
Swimmer richness	3		

Aquatic Invertebrate Taxonomic Data
Site Name MCCORMICK CREEK 0.25 MI ABV MOUTH **STORET STATION** C04MCORC01

Date Collected 7 /24/2003 **Activity ID** 03-C209-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
		Nematoda	1	0.34%	Yes	5	PA
Acarina							
	Acari						
		Acari	1	0.34%	Yes	5	PR
Coleoptera							
	Elmidae						
		Heterlimnius	23	7.72%	Yes	3	CG
		Lara avara	3	1.01%	Yes	1	SH
		Optioservus	1	0.34%	Yes	5	SC
		Zaitzevia	17	5.70%	Yes	5	CG
Diptera							
	Chironomidae						
		Brillia	10	3.36%	Yes	4	SH
		Cricotopus (Cricotopus)	9	3.02%	Yes	7	SH
		Cricotopus (Nostococladius)	54	18.12%	Yes	6	SH
		Cricotopus bicinctus	3	1.01%	Yes	7	SH
		Eukiefferiella Devonica Gr.	4	1.34%	Yes	8	CG
		Micropsectra	1	0.34%	Yes	4	CG
		Nilotanypus	1	0.34%	Yes	6	PR
		Pagastia	2	0.67%	Yes	1	CG
		Polypedilum	3	1.01%	Yes	6	SH
		Thienemanniella	3	1.01%	Yes	6	CG
		Thienemannimyia Gr.	6	2.01%	Yes	5	PR
	Empididae						
		Empididae	2	0.67%	Yes	6	PR
	Simuliidae						
		Simulium	4	1.34%	Yes	6	CF
	Tipulidae						
		Antocha	3	1.01%	Yes	3	CG
Ephemeroptera							
	Baetidae						
		Baetis tricaudatus	6	2.01%	Yes	4	CG
		Diphetor hageni	1	0.34%	Yes	5	CG
	Ephemerellidae						
		Drunella coloradensis	2	0.67%	Yes	0	PR
		Drunella spinifera	1	0.34%	Yes	0	PR
		Serratella tibialis	13	4.36%	Yes	2	CG
	Heptageniidae						
		Cinygmula	9	3.02%	Yes	0	SC
		Epeorus longimanus	2	0.67%	Yes	1	SC
		Rhithrogena	3	1.01%	Yes	0	CG
Haplotaxida							
	Enchytraeidae						
		Enchytraeidae	1	0.34%	Yes	4	CG
Plecoptera							
	Nemouridae						
		Malenka	2	0.67%	Yes	1	SH
		Visoka cataractae	2	0.67%	Yes	0	SH
		Zapada columbiana	2	0.67%	Yes	2	SH
	Perlidae						
		Doroneuria	6	2.01%	Yes	0	PR
		Perlidae	2	0.67%	No	2	PR
	Perlodidae						
		Megarcys	6	2.01%	Yes	1	PR
Trichoptera							
	Brachycentridae						
		Micrasema	25	8.39%	Yes	1	SH

(Continued.....)

Site Name MCCORMICK CREEK 0.25 MI ABV MOUTH **STORET STATION** C04MCORC01

(...continued from previous page)

	Hydropsychidae						
		Arctopsyche grandis	2	0.67%	Yes	2	PR
		Hydropsyche	4	1.34%	Yes	5	CF
		Hydropsychidae	2	0.67%	No	4	CF
	Hydroptilidae						
		Agraylea	2	0.67%	Yes	8	PH
		Hydroptila	1	0.34%	Yes	6	PH
		Ochrotrichia	35	11.74%	Yes	4	PH
	Philopotamidae						
		Dolophilodes	1	0.34%	Yes	0	CF
	Rhyacophilidae						
		Rhyacophila	4	1.34%	No	1	PR
		Rhyacophila Betteni Gr.	3	1.01%	Yes	0	PR
		Rhyacophila Brunnea Gr.	4	1.34%	Yes	2	PR
Tricladida							
	Planariidae						
		Polycelis coronata	6	2.01%	Yes	1	OM
Grand Total			298				

Aquatic Invertebrate Data Summary

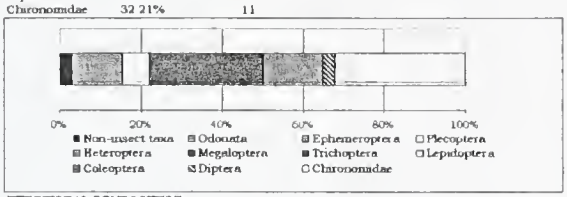
Project ID: MTDEQ03C04
STORET Station ID: C04MCORC01
Station Name: MCCORMICK CREEK 0.25 MI ABV MOUTH

Activity ID: 03-C209-M
Sample Date: 7/24/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	298
Portion of sample used	20.00%
Estimated number in total sample	1490
Sampling effort	
Time	DURATION 1:15 MINUTES / 20 FEET
Distance	
Jabs	
Habitat type	
EPT abundance	140
Taxa richness	44
Number EPT taxa	22
Percent EPT	46.98%

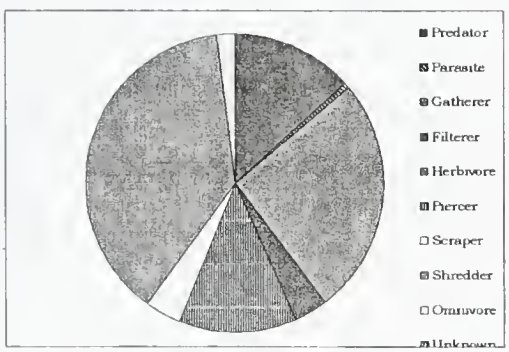
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	3.02%	4
Odonata	0.00%	0
Ephemeroptera	12.42%	8
Plecoptera	6.71%	6
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	27.85%	11
Lepidoptera	0.00%	0
Coleoptera	14.77%	4
Diptera	3.02%	3
Chironomidae	32.21%	11



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	13.42%	13
Parasite	0.34%	1
Gatherer	25.84%	12
Filterer	3.69%	4
Herbivore	0.00%	0
Piercer	12.75%	3
Scraper	4.03%	3
Shredder	37.92%	10
Omnivore	2.01%	1
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	1
Percent sediment tolerant	1.01%
Sediment sensitive taxa	3
Percent sediment sensitive	19.13%
Metals tolerance index (McGuire)	3.15
Cold stenotherm taxa	7
Percent cold stenotherms	24.16%

HABITUS MEASURES

Hemoglobin bearer richness	1
Percent hemoglobin bearers	1.01%
Air-breather richness	1
Percent air-breathers	1.01%
Burrower richness	1
Percent burrowers	3.36%
Swimmer richness	2
Percent swimmers	2.35%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Cricotopus (Nostocoladius)	54	18.12%
Ochrotrichia	35	11.74%
Micrasema	25	8.39%
Heterlimnius	23	7.72%
Zaitzevia	17	5.70%
SUBTOTAL 5 DOMINANTS	154	51.68%
Serratella tibialis	13	4.36%
Brilia	10	3.36%
Cinygmula	9	3.02%
Cricotopus (Cricotopus)	9	3.02%
Polycelis coronata	6	2.01%
TOTAL DOMINANTS	201	67.45%

SAPROBITY

Hilsenhoff Biotic Index	3.65

DIVERSITY

Shannon H (loge)	3.32
Shannon H (log2)	3.69
Margalef D	8.07
Simpson D	0.07
Evenness	0.08

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	19	50.00%
Univoltine	20	32.89%
Semivoltine	5	17.11%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	4	18.12%
Sensitive	7	24.16%
Clinger	26	80.20%

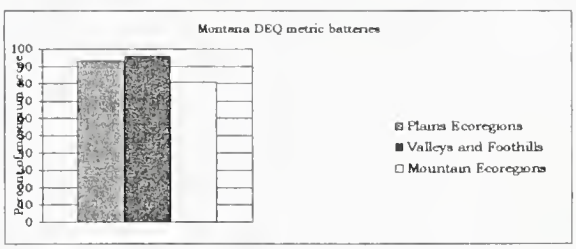
BIOASSESSMENT INDICES

H-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	44	5	
E richness	8	3	
P richness	6	3	
T richness	11	5	
Long lived	5	5	
Sensitive richness	7	5	
%tolerant	18.12%	5	
%predators	13.42%	3	
Clinger richness	26	5	
%dominance (3)	38.26%	5	
	TOTAL SCORE	44	88%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	44	3	3	3
EPT richness	22	3	3	3
Biotic Index	3.65	3	3	2
%Dominant taxon	18.12%	3	3	3
%Collectors	29.53%	3	3	3
%EPT	46.98%	2	2	1
Shannon Diversity	3.69	3		
%Scrapers +Shredders	41.95%	3	3	2
Predator taxa	13	3		
%Multivoltine	50.00%	2		
%H of T	9.64%		3	
TOTAL SCORES		28	23	17
PERCENT OF MAXIMUM		93.33	95.83	80.95
IMPAIRMENT CLASS		NON	NON	SLIGHT



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	22	E richness	8
Percent EPT	46.98%	T richness	11
Percent Oligochaetes and Leeches	0.34%	Percent EPT	46.98%
Percent 2 dominants	29.87%	Percent non-insect	3.02%
Filterer richness	4	Filterer richness	4
Percent intolerant	33.56%	Univoltine richness	20
Univoltine richness	20	Percent supertolerant	2.01%
Percent clingers	80.20%		
Swimmer richness	2		

Aquatic Invertebrate Taxonomic Data
Site Name CEDAR CREEK .5-.75 MI UP STARK MTN. TRAIL #58 ABV FS **STORET STATION** C04CEDRC01

Date Collected 7 /29/2003 **Activity ID** 03-C215-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
		Ostracoda	1	0.30%	Yes	8	CG
Acarina							
	Acari						
		Acari	5	1.52%	Yes	5	PR
Basommatophora							
	Planorbidae						
		Gyraulus	1	0.30%	Yes	8	SC
Coleoptera							
	Elmidae						
		Cleptelmis	6	1.82%	Yes	4	CG
		Lara avara	2	0.61%	Yes	1	Sl1
		Narpus	2	0.61%	Yes	2	CG
		Zaitzevia	2	0.61%	Yes	5	CG
Diptera							
	Ceratopogonidae						
		Ceratopogoninae	1	0.30%	Yes	6	PR
	Chironomidae						
		Brillia	24	7.29%	Yes	4	SH
		Cricotopus (Cricotopus)	4	1.22%	Yes	7	SH
		Eukiefferiella Brehmi Gr.	3	0.91%	Yes	8	CG
		Eukiefferiella Devonica Gr.	11	3.34%	Yes	8	CG
		Micropsectra	8	2.43%	Yes	4	CG
		Parametriocnemus	1	0.30%	Yes	5	CG
		Pseudodiamesa	1	0.30%	Yes	2	CG
		Tvetenia	4	1.22%	Yes	5	CG
	Empididae						
		Oreogeton	4	1.22%	Yes	4	PR
	Simuliidae						
		Prosimulium	35	10.64%	Yes	4	CF
		Simulium	5	1.52%	Yes	6	CF
	Tipulidae						
		Dicranota	1	0.30%	Yes	3	PR
		Tipula	2	0.61%	Yes	4	SH
Ephemeroptera							
	Baetidae						
		Baetis tricaudatus	10	3.04%	Yes	4	CG
	Ephemerellidae						
		Drunella doddsi	1	0.30%	Yes	1	PR
		Drunella spinifera	6	1.82%	Yes	0	PR
		Serratella tibialis	39	11.85%	Yes	2	CG
	Heptageniidae						
		Cinygmula	12	3.65%	Yes	0	SC
		Ironodes	4	1.22%	Yes	0	SC
		Rhithrogena	13	3.95%	Yes	0	CG
	Leptophlebiidae						
		Paraleptophlebia	2	0.61%	Yes	1	CG
Plecoptera							
	Chloroperlidae						
		Sweltsa	2	0.61%	Yes	0	PR
	Nemouridae						
		Visoka cataractae	11	3.34%	Yes	0	SH
		Zapada columbiana	4	1.22%	Yes	2	SH
		Zapada Oregonensis Gr.	1	0.30%	Yes	2	SH
	Peltoperlidae						
		Yoraperla brevis	18	5.47%	Yes	0	SH
	Perlidae						
		Doroneuria	10	3.04%	Yes	0	PR

(Continued.....)

Name CEDAR CREEK .5-.75 MI UP STARK MTN. TRAIL #58 ABV FS **STORET STATION** C04CEDRC01

(...continued from previous page)

	Perlodidae						
		Megarcys	1	0.30%	Yes	1	PR
		Setvena	1	0.30%	Yes	2	PR
Trichoptera							
	Brachycentridae						
		Micrasema	17	5.17%	Yes	1	SH
	Hydropsychidae						
		Arctopsychinae	3	0.91%	No	2	PR
		Parapsyche elsis	14	4.26%	Yes	1	PR
	Limnephilidae						
		Dicosmoecus	2	0.61%	Yes	2	SC
	Philopotamidae						
		Philopotamidae	2	0.61%	Yes	3	CF
	Rhyacophilidae						
		Rhyacophila	2	0.61%	No	1	PR
		Rhyacophila Betteni Gr.	4	1.22%	Yes	0	PR
		Rhyacophila Brunnea Gr.	8	2.43%	Yes	2	PR
Tricladida							
	Planariidae						
		Polycelis coronata	19	5.78%	Yes	1	OM
Grand Total			329				

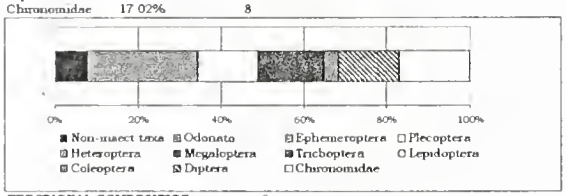
Aquatic Invertebrate Data Summary

Project ID:	MTDEQ03C04	**Activity ID:**	03-C215-M
STORET Station ID:	C04CEORC01		
Station Name:	CEDAR CREEK 5-75 MI UP STARK MTN TRAIL #58 ABV FS 5515	**Sample Date:**	7/29/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	329
Portion of sample used	45.00%
Estimated number in total sample	731
Sampling effort	
Time	DURATION: 2-10 MINUTES / 20 FEET
Distance	
Jabe	
Habitat type	
EPT abundance	187
Taxa richness	44
Number EPT taxa	22
Percent EPT	56.84%

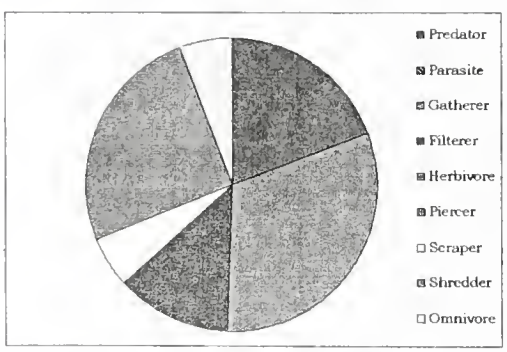
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	7.90%	4
Odonata	0.00%	0
Ephemeroptera	26.44%	8
Plecoptera	14.59%	8
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	15.81%	8
Lepidoptera	0.00%	0
Coleoptera	3.65%	4
Diptera	14.59%	6
Chironomidae	17.02%	8



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	19.15%	15
Parasite	0.00%	0
Gatherer	31.31%	14
Filterer	12.77%	3
Herbivore	0.00%	0
Piercer	0.00%	0
Scraper	5.78%	4
Shredder	25.23%	9
Omnivore	5.78%	1
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	3
Percent sediment tolerant	1.22%
Sediment sensitive taxa	1
Percent sediment sensitive	4.26%
Metals tolerance index (McGuire)	2.24
Cold stenotherm taxa	9
Percent cold stenotherms	20.97%

HABITOS MEASURES

Hemoglobin bearer richness	1
Percent hemoglobin bearers	0.30%
Air breather richness	2
Percent air-breathers	0.91%
Burrower richness	5
Percent burrowers	9.73%
Swimmer richness	2
Percent swimmers	3.65%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Serratella tibialis	39	11.85%
Prosimulium	35	10.64%
Brilia	24	7.29%
Polycelis coronata	19	5.78%
Yoraperla brevis	18	5.47%
SUBTOTAL 5 DOMINANTS	135	41.03%
Micrasema	17	5.17%
Parapsyche elsis	14	4.26%
Rhithrogena	13	3.95%
Cinygmula	12	3.65%
Visoka cataractae	11	3.34%
TOTAL DOMINANTS	202	61.40%

SAPROBITY

Hilsenhoff Biotic Index	2.42

DIVERSITY

Shannon H (loge)	5.96
Shannon H (log2)	4.14
Margalef D	7.76
Simpson D	0.05
Evenness	0.09

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	12	27.66%
Univoltine	27	61.09%
Semivoltine	5	11.25%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	3	2.74%
Sensitive	10	21.28%
Clinger	20	60.79%

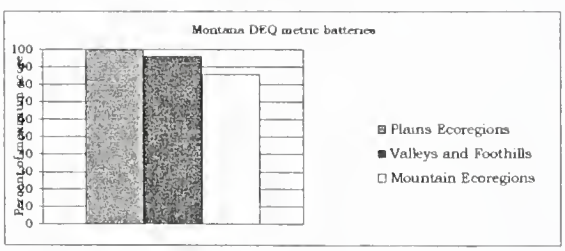
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	44	5	
E richness	8	3	
P richness	8	5	
T richness	8	3	
Long-lived	5	5	
Sensitive richness	10	5	
%tolerant	2.74%	5	
%predators	19.15%	3	
Clinger richness	20	3	
%dominance (3)	29.79%	5	
	TOTAL SCORE	42	84%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	44	3	3	3
EPT richness	22	3	3	3
Biotic Index	2.42	3	3	3
%Dominant taxon	11.85%	3	3	3
%Collectors	44.07%	3	3	3
%EPT	56.84%	3	2	2
Shannon Diversity	4.14	3		
%Scrapers +Shredders	31.00%	3	3	1
Predator taxa	15	3		
%Multivoltine	27.66%	3		
%H of T	32.69%		3	
TOTAL SCORES		30	23	18
PERCENT OF MAXIMUM		100.00	95.83	85.71
IMPAIRMENT CLASS		NON	NON	NON



Montana Plains ecoregions metrics (Brambiett and Johnson)

Riffle		*Pool*	
EPT richness	22	E richness	8
Percent EPT	56.84%	T richness	8
Percent Oligochaetes and Leeches	0.00%	Percent EPT	56.84%
Percent 2 dominants	22.49%	Percent non-insect	7.90%
Filterer richness	3	Filterer richness	3
Percent intolerant	60.49%	Univoltine richness	27
Univoltine richness	27	Percent supertolerant	4.86%
Percent clingers	60.79%		
Swimmer richness	2		

Aquatic Invertebrate Taxonomic Data
Site Name STONY CREEK ABOUT 250 YDS ABV FR 5490 XING **STORET STATION** C04STNYC01

Date Collected 7 /24/2003 **Activity ID** 03-C208-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
Acarina							
	Acari						
		Acari	1	0.34%	Yes	5	PR
Coleoptera							
	Dytiscidae						
		Sanfilippodytes	1	0.34%	Yes		
	Elmidae						
		Cleptelmis	3	1.01%	Yes	4	CG
		Heterlimnius	1	0.34%	Yes	3	CG
Diptera							
	Chironomidae						
		Brillia	11	3.69%	Yes	4	SH
		Corynoneura	1	0.34%	Yes	7	CG
		Eukiefferiella Devonica Gr.	2	0.67%	Yes	8	CG
		Heterotrissocladius	3	1.01%	Yes	0	CG
		Micropsectra	35	11.74%	Yes	4	CG
		Parametriocnemus	2	0.67%	Yes	5	CG
		Rheocricotopus	4	1.34%	Yes	4	CG
		Thienemanniella	1	0.34%	Yes	6	CG
		Thienemannimyia Gr.	4	1.34%	Yes	5	PR
		Tvetenia	2	0.67%	Yes	5	CG
	Simuliidae						
		Prosimulium	3	1.01%	Yes	4	CF
		Simulium	15	5.03%	Yes	6	CF
Ephemeroptera							
	Ameletidae						
		Ameletus	17	5.70%	Yes	0	CG
	Baetidae						
		Diphetor hageni	3	1.01%	Yes	5	CG
	Ephemerellidae						
		Drunella coloradensis	1	0.34%	Yes	0	PR
		Drunella spinifera	1	0.34%	Yes	0	PR
		Serratella tibialis	12	4.03%	Yes	2	CG
	Heptageniidae						
		Cinygma	6	2.01%	Yes	0	SC
		Cinygmula	3	1.01%	Yes	0	SC
		Epeorus deceptivus	1	0.34%	Yes	0	SC
	Leptophlebiidae						
		Paraleptophlebia	4	1.34%	Yes	1	CG
Plecoptera							
	Chloroperlidae						
		Sweltsa	2	0.67%	Yes	0	PR
	Nemouridae						
		Visoka cataractae	8	2.68%	Yes	0	SH
		Zapada columbiana	5	1.68%	Yes	2	SH
		Zapada Oregonensis Gr.	3	1.01%	Yes	2	SH
	Peltoperlidae						
		Yoraperla brevis	14	4.70%	Yes	0	SH
	Perlodidae						
		Setvena	3	1.01%	Yes	2	PR
Trichoptera							
	Brachycentridae						
		Micrasema	47	15.77%	Yes	1	SH
	Hydropsychidae						
		Parapsyche elsis	5	1.68%	Yes	1	PR
	Limnephilidae						
		Chyrandra centralis	1	0.34%	Yes	2	SH
		Cryptochia	2	0.67%	Yes	0	SH
		Dicosmoecus gilvipes	2	0.67%	Yes	2	SC
		Limnephilidae	3	1.01%	Yes	3	SH

(Continued.....)

Site Name STONY CREEK ABOUT 250 YDS ABV FR 5490 XING **STORET STATION** C04STNYC01

(..continued from previous page)

	Rhyacophilidae						
		Rhyacophila Betteni Gr.	8	2.68%	Yes	0	PR
		Rhyacophila Brunnea Gr.	2	0.67%	Yes	2	PR
		Rhyacophila Iranda Gr.	9	3.02%	Yes	0	PR
		Rhyacophila narvae	2	0.67%	Yes	0	PR
		Rhyacophila Verrula Gr.	7	2.35%	Yes	0	MH
	Uenoidae						
		Neothremma	3	1.01%	Yes	1	SC
Tricladida							
	Planariidae						
		Polycelis coronata	35	11.74%	Yes	1	OM
Grand Total			298				

Aquatic Invertebrate Data Summary

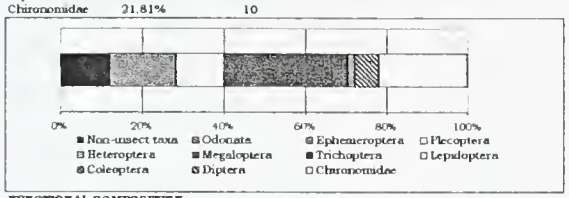
Project ID: MTDEQ03C04
STORET Station ID: C04STNYC01
Station Name: STONY CREEK ABOOT 250 YDS ABV FR 5490 XING

Activity ID: 03-C208-M
Sample Date: 7/24/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	298
Portion of sample used	36.67%
Estimated number in total sample	813
Sampling effort	
Time	DURATION: 1.50 MINUTES / 18 FEET
Distance	
Jabs	
Habitat type	
EPT abundance	174
Taxa richness	44
Number EPT taxa	27
Percent EPT	58.39%

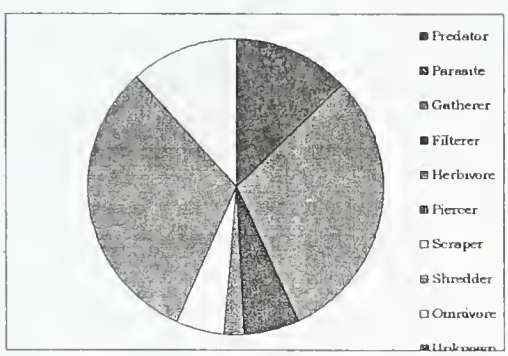
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	12.08%	2
Odonata	0.00%	0
Ephemeroptera	16.11%	9
Plecoptera	11.74%	6
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	30.54%	12
Lepidoptera	0.00%	0
Coleoptera	1.68%	3
Diptera	6.04%	2
Chironomidae	21.81%	10



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	12.75%	11
Parasite	0.00%	0
Gatherer	30.20%	14
Filterer	6.04%	2
Herbivore	2.35%	1
Piercer	0.00%	0
Scraper	5.03%	5
Shredder	31.54%	9
Omnivore	11.74%	1
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	0
Percent sediment tolerant	0.00%
Sediment sensitive taxa	1
Percent sediment sensitive	1.68%
Metals tolerance index (McGuire)	1.92
Cold stenotherm taxa	11
Percent cold stenotherms	17.79%

HABITUS MEASURES

Hemoglobin bearer richness	0
Percent hemoglobin bearers	0.00%
Air-breather richness	1
Percent air-breathers	0.34%
Burrower richness	1
Percent burrowers	3.69%
Swimmer richness	3
Percent swimmers	8.05%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Micrasema	47	15.77%
Polycelis coronata	35	11.74%
Micropsectra	35	11.74%
Ameletus	17	5.70%
Simulium	13	5.03%
SUBTOTAL 5 DOMINANTS	149	50.00%
Yoraperla brevis	14	4.70%
Serratella tibialis	12	4.03%
Baetis	11	3.69%
Rhyacophila brunda Gr	9	3.02%
Visoka cataractae	8	2.68%
TOTAL DOMINANTS	203	68.12%

SAPROBITY

Hilsenhoff Biotic Index	1.90

DIVERSITY

Shannon H (loge)	3.28
Shannon H (log2)	3.67
Margalef D	7.54
Simpson O	0.07
Evenness	0.08

VOLTINISM

TYPE	# TAXA	PERCENT
Multivoltine	13	34.90%
Univoltine	26	61.07%
Semivoltine	5	4.03%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	1	1.01%
Sensitive	13	19.80%
Clinger	18	46.98%

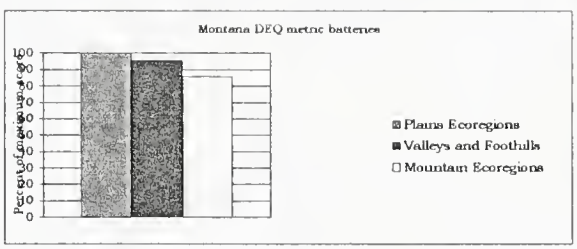
BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE	
Taxa richness	44	5	
E richness	9	5	
P richness	6	3	
T richness	12	5	
Long-lived	5	5	
Sensitive richness	13	5	
%tolerant	1.01%	5	
%predators	12.75%	3	
Clinger richness	18	3	
%dominence (3)	39.26%	5	
	TOTAL SCORE	44	88%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	44	3	3	3
EPT richness	27	3	3	3
Biotic Index	1.90	3	3	3
%Dominant taxon	15.77%	3	3	3
%Collectors	36.24%	3	3	3
%EPT	58.39%	3	2	2
Shannon Diversity	3.67	3		
%Scrapers +Shredders	36.58%	3	3	1
Predator taxa	11	3		
%Multivoltine	34.90%	3		
%H of T	5.49%		3	
TOTAL SCORES		30	23	18
PERCENT OF MAXIMUM		100.00	95.83	85.71
IMPAIRMENT CLASS		NON	NON	NON



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		Pool	
EPT richness	27	E richness	9
Percent EPT	58.39%	T richness	12
Percent Oligochaetes and Leeches	0.00%	Percent EPT	58.39%
Percent 2 dominants	27.52%	Percent non-insect	12.08%
Filterer richness	2	Filterer richness	2
Percent intolerant	69.46%	Univoltine richness	26
Univoltine richness	26	Percent supertolerant	0.67%
Percent clingers	46.98%		
Swimmer richness	3		

Aquatic Invertebrate Taxonomic Data
Site Name STONY CREEK 0.25 MI U/S MOUTH 9 MILE CREEK **STORET STATION** C04STNYC02

Date Collected 7 /23/2003 **Activity ID** 03-C207-M

Order	Family	Taxon	Count	Percent	Unique	BI	FFG
Acarina							
	Acari						
		Acari	2	0.65%	Yes	5	PR
Coleoptera							
	Elmidae						
		Cleptelmis	9	2.91%	Yes	4	CG
		Elmidae	4	1.29%	No	4	CG
		Heterlimnius	15	4.85%	Yes	3	CG
		Lara avara	1	0.32%	Yes	1	SH
		Zaitzevia	1	0.32%	Yes	5	CG
Diptera							
	Chironomidae						
		Brillia	3	0.97%	Yes	4	SH
		Cricotopus (Cricotopus)	4	1.29%	Yes	7	SH
		Cricotopus (Nostococladius)	11	3.56%	Yes	6	SH
		Eukiefferiella Devonica Gr.	3	0.97%	Yes	8	CG
		Eukiefferiella Gracei Gr.	1	0.32%	Yes	8	CG
		Eukiefferiella Pseudomontana Gr.	2	0.65%	Yes	8	CG
		Micropsectra	6	1.94%	Yes	4	CG
		Orthocladius	2	0.65%	Yes	6	CG
		Pagastia	38	12.30%	Yes	1	CG
		Rheocricotopus	1	0.32%	Yes	4	CG
		Symposiocladius	1	0.32%	Yes	5	SH
		Tvetenia	42	13.59%	Yes	5	CG
	Ephydridae						
		Ephydridae	1	0.32%	Yes	6	CG
	Simuliidae						
		Simulium	8	2.59%	Yes	6	CF
	Tipulidae						
		Dicranota	1	0.32%	Yes	3	PR
Ephemeroptera							
	Ameletidae						
		Ameletus	1	0.32%	Yes	0	CG
	Baetidae						
		Baetis tricaudatus	7	2.27%	Yes	4	CG
	Ephemerellidae						
		Drunella coloradensis	3	0.97%	Yes	0	PR
		Drunella spinifera	2	0.65%	Yes	0	PR
		Serratella tibialis	19	6.15%	Yes	2	CG
	Heptageniidae						
		Epeorus longimanus	17	5.50%	Yes	1	SC
	Leptophlebiidae						
		Paraleptophlebia	3	0.97%	Yes	1	CG
Plecoptera							
	Chloroperlidae						
		Sweltsa	4	1.29%	Yes	0	PR
	Nemouridae						
		Malenka	5	1.62%	Yes	1	SH
Trichoptera							
	Hydroptilidae						
		Hydroptila	5	1.62%	Yes	6	PH
	Lepidostomatidae						
		Lepidostoma (turret case)	2	0.65%	Yes	1	SH
	Limnephilidae						
		Limnephilidae	2	0.65%	Yes	3	SH
	Philopotamidae						
		Dolophilodes	6	1.94%	Yes	0	CF
		Philopotamidae	4	1.29%	No	3	CF
		Wormaldia	2	0.65%	Yes	0	CF

(Continued.....)

Site Name STONY CREEK 0.25 MI U/S MOUTH 9 MILE CREEK **STORET STATION** C04STNYC02

(...continued from previous page)

	Rhyacophilidae						
		Rhyacophila Betteni Gr.	4	1.29%	Yes	0	PR
		Rhyacophila Brunnea Gr.	5	1.62%	Yes	2	PR
		Rhyacophila narvae	1	0.32%	Yes	0	PR
Tricladida							
	Planariidae						
		Polycelis coronata	56	18.12%	Yes	1	OM
Veneroida							
	Pisidiidae						
		Pisidiidae	5	1.62%	Yes	8	CG
Grand Total			309				

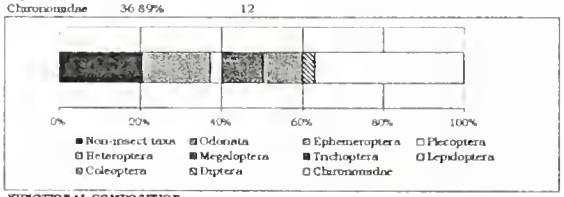
Aquatic Invertebrate Data Summary

Project ID:	MTDEQ03C04	**Activity ID:**	03-C207-M
STORET Station ID:	C04STNYC02		
Station Name:	STONY CREEK 0.25 MI U/S MOUTH 9 MILE CREEK	**Sample Date:**	7/23/2003

Sample type	KICK
SUBSAMPLE TOTAL ORGANISMS	309
Portion of sample used	8.33%
Estimated number in total sample	3708
Sampling effort	
Time	DURATION 1.15 MINUTES / 15 FEET
Distance	
Jabs	
Habitat type	
EPT abundance	92
Taxa richness	39
Number EPT taxa	17
Percent EPT	29.77%

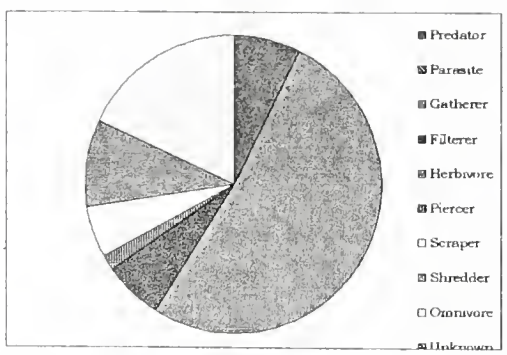
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA
Non-insect taxa	20.39%	3
Odonata	0.00%	0
Ephemeroptera	16.83%	7
Plecoptera	2.91%	2
Heteroptera	0.00%	0
Megaloptera	0.00%	0
Trichoptera	10.03%	9
Lepidoptera	0.00%	0
Coleoptera	9.71%	5
Diptera	3.24%	3
Chironomidae	36.89%	12



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA
Predator	7.12%	8
Parasite	0.00%	0
Gatherer	51.78%	18
Filterer	6.47%	4
Herbivore	0.00%	0
Piercer	1.62%	1
Scraper	5.50%	1
Shredder	9.39%	8
Omnivore	18.12%	1
Unknown	0.00%	0



COMMUNITY TOLERANCES

Sediment tolerant taxa	1
Percent sediment tolerant	0.32%
Sediment sensitive taxa	3
Percent sediment sensitive	6.15%
Metals tolerance index (McGuire)	3.81
Cold stenotherm taxa	3
Percent cold stenotherms	6.15%

HABITUS MEASURES

Hemoglobin bearer richness	0
Percent hemoglobin bearers	0.00%
Air-breather richness	1
Percent air-breathers	0.32%
Burrower richness	2
Percent burrowers	1.29%
Swimmer richness	3
Percent swimmers	3.56%

DOMINANCE

TAXON	ABUNDANCE	PERCENT
Polycelis coronata	56	18.12%
Tvetenia	42	13.59%
Pagastia	38	12.30%
Serratella tibialis	19	6.15%
Epeorus longimanus	17	5.50%
SUBTOTAL 5 DOMINANTS	172	55.66%
Heterlimnius	15	4.85%
Cricotopus (Nostococladius)	11	3.56%
Cleptelmis	9	2.91%
Simulium	8	2.59%
Baetis tricaudatus	7	2.27%
TOTAL DOMINANTS	222	71.84%

SAPROBITY

Hilsenhoff Biotic Index	2.80

DIVERSITY

Shannon H (loge)	4.84
Shannon H (log2)	3.36
Margalef D	6.97
Simpson D	0.08
Evenness	0.08

VOLTINISM

TYPE	#TAXA	PERCENT
Multivoltine	16	59.55%
Univoltine	20	31.07%
Semivoltine	3	9.39%

TAXA CHARACTERS

	#TAXA	PERCENT
Tolerant	3	4.85%
Sensitive	3	6.15%
Clinger	17	39.16%

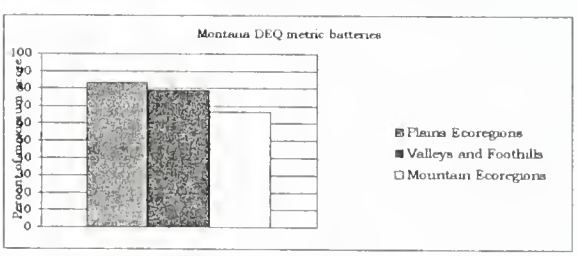
BIOASSESSMENT INDICES

B-IBI (Barr et al.)

METRIC	VALUE	SCORE	
Taxa richness	39	3	
E richness	7	3	
P richness	2	1	
T richness	9	3	
Long-lived	3	3	
Sensitive richness	3	3	
%tolerant	4.85%	5	
%predators	7.12%	1	
Clinger richness	17	3	
%dominance (3)	44.01%	5	
	TOTAL SCORE	30	60%

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	39	3	3	3
EPT richness	17	3	3	2
Biotic Index	2.80	3	3	3
%Dominant taxon	18.12%	3	3	3
%Collectors	58.25%	3	3	3
%EPT	29.77%	1	0	0
Shannon Diversity	3.36	3		
%Scrapers +Shredders	14.89%	1	1	0
Predator taxa	8	3		
%Multivoltine	59.55%	2		
%H of T	0.00%		3	
TOTAL SCORES		25	19	14
PERCENT OF MAXIMUM		83.33	79.17	66.67
IMPAIRMENT CLASS		NON	SLIGHT	SLIGHT



Montana Plains ecoregions metrics (Bramblett and Johnson)

Riffle		*Pool*	
EPT richness	17	E richness	7
Percent EPT	29.77%	T richness	9
Percent Oligochaetes and Leeches	0.00%	Percent EPT	29.77%
Percent 2 dominants	31.73%	Percent non-insect	20.39%
Filterer richness	4	Filterer richness	4
Percent intolerant	54.69%	Univoltine richness	20
Univoltine richness	20	Percent supertolerant	3.56%
Percent clingers	39.16%		
Swimmer richness	3		